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## RICE.

In reviewing the last Annual Report of the Department of Agriculture, one of the Ceylon morning papers comments somewhat adversely on the amount of interest taken by the Department in the cultivation of rice. With part of that criticism we find ourselves in agreement, and we would venture to express the hope that when men are again available and the Department is fully staffed, it may be found possible to take up the investigation and improvement of the staple food product of the Island.

It is indeed remarkable that the cultivation of rice should have been so long neglected, not only in Ceylon but also in other countries. In the more temperate rice growing centres, in Italy and Japan for example, attention has been given to this matter for many years now, and in the case of the former, at least, with excellent results. More recently, tropical countries have followed their example, and in India, British Guiana, Annam, and the Philippines, investigations are now in progress, while Java, with its accustomed thoroughness, has instituted an Experiment Station specially devoted to rice.

The experiences of the countries referred to show clearly the paths to be followed. We must begin with the plant. Ordinary processes of selection and the distribution of selected seed may be relied on to improve the yield from the present area, and once the goodwill of the cultivator has been gained by such a course, he would be more likely to give heed to suggested new methods of cultivation. The periodic introductions of new varieties of paddy which are at once put into cultivation has now

been carried on for nearly a century, and the results are with us. Such introductions are in a sense an attempt to take advantage of the investigations of other countries, but they ignore the possibility that the varieties in question have been evolved or selected under different conditions, and may not remain constant or prove suitable in Ceylon. Introduce, by all means, but subject the introductions to a process of selection, and select also from our native strains. T. P.

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## CROSS-POLLINATING TREES.

A few suggestions on the technique of cross-pollinating trees may be useful to those who want to try the artificial production of vigorous trees. Both male and female flowers should be protected with bags, in order to prevent the possibility of a mix-up in heredity through the presence of foreign pollen. The male flowers should be bagged a week before they shed their pollen, while the female flowers may be protected for a fortnight before the stigmas are receptive and a week after the cross-pollination has been made. If the tree with which one is working has perfect flowers and is to be used as the seed-bearing parent, the pollen-bearing organs must of course be removed at an early stage, with a needle-pointed forceps. This operation is a delicate one, particularly as it must be carried out at the top of a lofty tree, swaying in the wind. Sometimes it may not be necessary, if the flowers are protected by nature from self-pollination. In the case of the ash and elm, for example, the stigmas are receptive some days before the anthers shed their pollen. Under these circumstances, the pollen from another species may be applied to the stigma, and no attention paid to the anthers.

### HANDLING TREE POLLEN.

"Pollen spoils by keeping, but it often must be kept for some time till the stigma of the female parent is receptive. It is often obtained from distant countries where trees of the desired species, flowering early, can be found. It is best kept in a small glass tube either corked or plugged with cotton wool. Pollen is usually collected by cutting off the flowering twigs and placing them on white paper in a dry place for one or two days.

"Pollen is applied with a camel's hair brush, and a minute quantity is sufficient for each stigma. The stigmas are to be pollinated when receptive, indicated by the presence on them of a sugary solution or by their change to a brighter hue. Pollen grains may not be able to germinate on the stigma of another species, and yet be capable of fertilizing it, if germination could be induced. The transference of a drop of the substance secreted by the stigma of the pollen-bearing species to the stigma of the other parent might induce germination. The best time for pollination is in the warm part of the day, between 11 a.m. and 3 p.m. in early spring. Cold, wet days should be avoided."—JOURNAL OF HEREDITY.

# RUBBER.

## DISEASES OF HEVEA.

The following is the full text of the lecture on "Diseases of Hevea" delivered by MR. T. PETCH, Acting Director of Agriculture, at Taldua, on the 23rd September, and at Tebuwana, on the 25th September :—

### FOMES SEMITOSTUS.

My first point concerns the identification of *Fomes semitostus*, or as it is more correctly called *Fomes lignosus*. *Fomes semitostus*, as you know, is one of the bracket fungi, that is, its fructification projects like a bracket from the side of the tree. The upper side of this fructification is, when fresh, a rich red-brown with a yellow margin, while the under surface is bright orange. Unfortunately it does not retain these colours, but, when old or dry, the upper surface becomes pale yellow-brown, or wood-coloured, with concentric darker lines, while the lower surface becomes red-brown. When the fructification is broken across, it is found to consist of two distinct layers, the upper part being white, and the lower part red-brown ; the latter part is formed by the tubes which contain the spores. Like most bracket fungi, the fructification of *Fomes semitostus* usually has a flat part which extends over the wood. On Hevea recently killed by *Fomes* this may be the only part of the fructification developed. We then get an orange plate with a yellow margin lying flat on the stem.

*Fomes semitostus* is identified by its colour—red-brown above, orange beneath, and red-brown and white in section. Of these the orange lower surface is the most distinctive. I do not recollect any other Ceylon fungus of this class which is orange underneath. We should have no difficulty in identifying *Fomes semitostus* if it always retained the colour of the fresh specimens. But when it dries it comes to resemble a very common fungus, known as *Polyporus zonalis*. When these two species are dried, it is difficult to distinguish between them. Indeed, I have had great trouble in persuading experts in this group of fungi, who handle them only in museums, that there really are two species. *Polyporus zonalis* is usually wood-coloured, a pale yellowish-brown, with concentric darker lines, on the upper surface ; it may be reddish when fresh, but it is never the deep-red-brown of *F. semitostus*. But the lower surface is quite different, and varies from creamy white to a peculiar livid grey. If a bracket fungus is white or livid beneath it is not *F. semitostus*. When broken across, *Polyporus zonalis* may be either white throughout or white above and red-brown below; in the latter case it is like *F. semitostus*, but at the present time most of the specimens of *Polyporus zonalis* which are sent in to me are white throughout. It may be that we shall have to split these into two different species. *Polyporus zonalis* is saprophytic, that is, it grows on dead wood only ; no one has yet found it parasitic ; it has a peculiar habit of forming its fructification on anything it happens to meet, such as stones and bricks.

When *Fomes semitostus* first appeared on Hevea in Ceylon, it attacked trees in clearings, and it was then determined that in all cases it originated on old jungle stumps, and spread from the stumps to the Hevea. Jak stumps and *Ficus* stumps were the most frequent points of origin. It was at first thought that some selective method of extracting jungle stumps, taking out, say, only the *Ficus* and jak stumps would be possible, but the fungus was afterwards found on stumps of so many different trees that that idea proved useless. It occurs on bamboo clumps, Bombax, Halmilla, Derris, etc., practically covering the whole range of flowering plants. To avoid *Fomes* on newly cleared land, all jungle stumps must be extracted. Some estates have not yet got rid of the *Fomes* which began on their jungle stumps in 1906.

Jungle stumps may be said to have disappeared to a great extent from estates, but we have now a new danger, viz., the Hevea stumps left in thinning out. It has now been definitely determined that these stumps, a few inches only above the surface, can serve as centres of origin for *Fomes semitostus*, *Ustulina zonata* and *Poria hypobrunnea*. When Hevea is felled the roots must be extracted. It is, of course, cheaper, at first, to cut them off at ground level, but it will become the most expensive in the end. If it is impossible to get out the roots, the taproot should be extracted to a depth of two feet, but it should be borne in mind that this is only the second best method. I may mention here that we have found brown root disease to spread to Hevea from ringed Grevilleas and from cocoa stumps, and I have no doubt we shall soon have records of brown root disease originating on Hevea stumps.

Another danger arises from abandoned tea under rubber. This was found some years ago to serve as a source of *Ustulina* which spread from the tea to the rubber. It is now giving serious trouble on some estates in connection with *Fomes semitostus*. *Fomes* either originates on the tea stumps and spreads from them to the Hevea, or it utilises them as a means of passage from one Hevea to the next.

*Fomes semitostus* has not hitherto been regarded as a tea root disease, but I have recently seen a case of *Fomes semitostus* on tea quite apart from any rubber, and, consequently, do not doubt that the fungus can originate on tea stumps. On the treatment of *Fomes*, I have nothing to add. It is the general treatment for root diseases, plus hard work. Extract all dead roots, following up the laterals as far as possible; burn all diseased roots on the spot; surround the area with a trench 2 feet deep, throwing the earth excavated towards the centre; fork over the patch with lime at the rate of at least 1 ton to the acre.

## USTULINA ZONATA.

This fungus is the cause of our commonest tea root disease. It is now known to attack Hevea, usually Hevea planted in tea. The fungus at first forms a white, rather soft plate which lies flat on the stem. This plate soon turns greenish. It then develops a hard crust on the surface and becomes purple-grey, finally weathering and becoming black. In its fully developed form, it is thin, sometimes flat, but more generally irregularly undulating, and very brittle. When just ripe, it is white internally, with a number of black, flask-shaped cavities which contain the spores, but when old it is black throughout and usually more or less hollow. Its brittle, crusty texture is a good distinguishing character. In the case of root disease of tea, *Ustulina zonata* usually begins on the stump of a felled Grevillea, and spreads from

that to the tea. It travels along the lateral roots of the Grevillea, and apparently only passes to the tea roots when these are in contact with the Grevillea roots. It has also been found to spread from abandoned tea to Hevea.

It has also been found to develop on cocoa stumps and Hevea stumps after thinning out. It attacks Hevea in three different ways. Probably the most serious is the root disease. In the instances I have seen of this, it usually attacked a lateral root first, and from that travelled to one side of the stem and taproot. Its effects are often local, a decayed area extending up the stem on one side only. Consequently, the tree usually dies gradually, the crown becoming thin owing to the drying up of the branches one by one.

We have a striking instance of this in the case of a *Eugenia* attacked by this fungus in the Botanic Gardens. To my knowledge it has been diseased since 1908, and the base of the tree on one side is encrusted with the fructification of *Ustulina*. Periodically, part of the crown dies, and then the withered leaves attract attention, but to the casual observer the tree is still quite a good specimen. It might be possible to save a tree attacked by *Ustulina* by cutting away the diseased tissues at the base and the diseased lateral root.

Another mode of attack is on the stem, usually where the wood has been exposed by a previous attack of canker or pink disease. In this case the fungus begins as a saprophyte on the dead wood and extends to the living tissues. To prevent this, all wounds which expose the wood should be tarred. The third method of attack is similar, but apparently does not require a previous open wound. In this case the fungus develops in the fork of a tree and extends downwards, the fructification sometimes covering the trunk for a foot or more. It was in this situation that *Ustulina* was first found on Hevea. The practice of clearing up the fork of a tree is, I think, a good one. We have a long list of trees which may be attacked by *Ustulina*. It was first found on coconut palms, but apparently only saprophytic. It has been known to cause root disease of *Casuarina*, *Pumelo*, *Cassia nodosa*, Halmilla, Lunumidella, Derris, tea, etc. The list discloses as wide a range as that of *Fomes semitostus*. Wood attacked by *Ustulina zonata* is permeated by black sheets which appear as lines when the wood is cut. This effect, however, is not confined to *Ustulina*. Dozens of other fungi which grow only on dead wood produce the same effect.

## PORIA HYPOBRUNNEA.

A new root disease was discovered at Peradeniya about two years ago. It occurred on a new clearing on the hillside on the Experiment Station, spreading evidently from decaying jungle stumps, and killed both Hevea and *Tephrosia candida*. The mycelium on the root and in the wood resembles that of *Poria hypolateritia*, a common tea root disease, and it was recorded as that species, but further investigation has shown that the fructification is different, so we have had to give it a new name and have called it *Poria hypobrunnea*.* The mycelium on the root takes the form of stout, red strands. When old these turn black, and as some sand and small stones often adhere to the mycelium, it resembles brown root disease to some extent. Inside the wood of the root and the lower part of the stem

* *Poria hypobrunnea,—Subruber; aetate brunneoruber, Margine albo, tomentoso; circa 1·5 mm. crassitudine; contextu fuscobrunneo, crasso, matricem arcte applicato; poris parvis, 0·1 mm. diam.*

the fungus forms bright red patches or sheets. A *Poria* is simply a *Fomes* or *Polyporus* which does not form a bracket, but spreads out flat over the surface of the host plant. *Poria hypobrunnea* forms a flat plate, about one-eighth of an inch thick, often extending for several inches, studded with minute holes, which are scarcely evident without a lens. It is white or yellowish at first, then reddish.

We have no record of this disease in Ceylon except in the neighbourhood of Peradeniya. There, it has occurred in a new clearing, and also in two localities on Hevea stumps after thinning. But it has recently been found on rubber in Malaya, so we may expect it to be a fairly wide-spread disease. I have brought it to your notice, as it is another proved case of a root disease originating on Hevea stumps.

**DIPLODIA.**

This has been known for many years under the name of "Dieback." In the "dieback" originally described, the tree died from the top downwards in regular order—first the leader, then the top whorl of branches, then the next whorl and so on down to the base. But during the last year or two this disease has in many cases taken a different course. One side of the tree is found to be dry, that is, it does not yield any latex. On cutting into the cortex, it is seen to be discoloured, usually a brownish colour, quite different from the claret colour of "canker." It may happen that the cortex is normally coloured, except on the inner surface where the cambium layer is brown. This effect is caused by *Botryodiplodia theobromæ—Diplodia* for short. In such cases, the fungus does not enter via the top shoot as in "dieback," but by a wound or an old stub. Once in the stem it travels upwards and downwards usually on one side and often most rapidly along the cambium. If a tree is badly attacked it must be cut down and burnt. If the diseased strip is narrow the affected cortex may be cut out and the wood tarred. To prevent attacks by this fungus, dead branches should be pruned off and all pruning cuts tarred.

If I were asked whether it were possible to eradicate *Fomes semitostus* from an estate, I should say that that was quite within the bounds of possibility. On the other hand, I should certainly consider it impossible to abolish *Botryodiplodia theobromæ*. This fungus is one of the commonest species we have, and it occurs in abundance in dying cocoa stems and pods, coconut and other palm stems, papaw, sugar-cane, *Ficus*, *Hevea*, and many other plants. It produces myriads of spores, and while the spores of *Fomes* rarely germinate, as far as we know, those of *Botryodiplodia* germinate readily. Fortunately, this fungus is chiefly a saprophyte. It prefers dead and decaying tissues, and it is not a very strong parasite.

But the fact that the fungus can be parasitic, brings forward the question "What shall we do with felled Hevea? Can the logs be left to rot in the plantation or must they be removed?" Well, anyone who chooses can carry out the following experiment. Take a newly felled Hevea log which was quite healthy when standing and leave it lying on the verandah or in any place under cover. Within a week or ten days, it will be found to be covered, especially on the under surface, with a black powder. The powder may be white at first, and subsequently turn black. It consists of millions of spores of *Botryodiplodia*. The development of *Botryodiplodia* on logs lying in the open appears to be slower than under the conditions just stated.

Now there is always some *Botryodiplodia* present in a Hevea plantation, on decayed pods, dead branches, etc., but it will be quite clear that felled Hevea increases the amount enormously. Can this be avoided? As the fungus develops in so short a time the ideal way would be to remove the logs as soon as they are felled and that is impracticable. Something, however, can be effected by stripping off the cortex and removing that as soon as the trees are felled, as the rapid development of the fungus is chiefly in the cortex. The danger from *Botryodiplodia* exists chiefly in the first few weeks after felling. When the log is evidently in a state of decay, the *Botryodiplodia* stage is over. There still remains the question whether it is advisable to remove Hevea logs, because of the possibility of the development of other fungi. It is certainly a sound policy, but is it worth the expense? I have never seen *Fomes semitostus* develop on Hevea logs, though I should not be surprised to find it on them in damp situations, i.e., on low-lying land or under dense shade. *Ustulina zonata*, however, would develop on Hevea logs in any situation. Taking all things into consideration, I should advise that Hevea logs be barked immediately after felling and the bark removed and burnt as soon as possible; that on low-lying ground the timber should certainly be removed; and that it would be preferable to remove it in all cases.

## FRUIT DISEASES AND CANKER.

My final subject is the group of diseases caused by the fungus, *Phytophthora Faberi*. I will not trouble you with a description of the fungus, as it is one which requires a microscope for its identification. There are four, or we might say five, manifestations of disease caused by *Phytophthora* on Hevea. The one which has been most prominent lately is the fruit disease. In this, as you all know, the fruits turn black, the outer layer becomes soft and decays, and the diseased fruits, instead of splitting and scattering their seeds, remain, as a rule, hanging on the tree. In the earlier stages, a delicate white mould, the *Phytophthora* which is the cause of the rot, spreads over the fruit, but it is, generally, soon overrun by other fungi. The fruit disease is worst in wet weather, because *Phytophthora* demands an abundance of moisture for rapid development. During the present season, the fruit disease has spread to the more elevated rubber districts. These are usually free from it because their seed crop ripens late, usually in September, in the dry weather. But owing to the abnormal rains of August and September, the fruit in these districts has been attacked this year. From the fruits, the fungus may spread to the green branches and cause them to die back. This causes a shedding of the leaves. The leaves, however, may also fall as a result of a direct attack of the fungus on them, due to spores which are blown or washed by the rain from the fruits to the leaves. When the fungus attacks the leaf stalk, the point of attack is usually indicated by a brown ring, but it can attack any part of the leaf and cause it ultimately to fall. The leaf fall is caused by the same fungus as the fruit disease, and it results either from the direct attack of the fungus on the leaf, or as a consequence of the death of the branch. A third form of disease caused by *Phytophthora* is the well-known Hevea stem canker. This illustration shows the peculiar claret coloured patch found on shaving away the outer bark. There is very little outward indication of *canker*. Sometimes there is a slight discoloration, and in advanced cases, a rusty liquid may exude. Any suspicious-looking patches should be lightly scraped. If

canker is present, the layer underlying the brown bark, which should be green, will be found to be black, while the colour of the cortex varies from a greyish sodden appearance in the early stages to the claret colour here shown. In spite of the slight external signs of canker, it is generally found that coolies become quite expert in spotting it. If left unchecked, these patches ultimately extend to the wood, and they may completely ring the tree and kill it, especially when the tree is attacked near the base. If dry weather intervenes, the diseased patch may dry up and scale off, but this is a chance which cannot be relied on. Yet another effect of *Phytophthora* is the decay of the tapped surface. In this, the most recently tapped cortex shows vertical black lines of decay, which extend into the wood. This decay may spread until adjacent areas coalesce and a large wound is formed across the tapped surface. It has now been proved by RUTGERS, DASTUR and MACRAE that this effect is the result of an infection of *Phytophthora*. The effect is peculiar, in that it differs completely in appearance from the usual effect of *Phytophthora* on the stem, but as we have now a positive result from infection experiments by three independent workers, the cause does not admit of doubt. We may deal with the treatment of these in the reverse order. When the tapped surface shows signs of decay, it should be brushed over twice a week for three weeks with a 20 per cent. solution of Brunolinum. *Carbolineum Plantarium* mixes with water, but Brunolinum does not, unless soft soap is added. The proportions are one gallon Brunolinum, 4 gallons of water and 1 lb. soft soap. Dissolve the soft soap in the water, add the Brunolinum and stir it up vigorously. If any difficulty is found in mixing, it should be worked up with a syringe. The Brunolinum separates out on standing, and it is necessary to distribute the mixture to the coolies in bottles, so that it can be shaken at intervals. Canker patches must be cut out, and the diseased tissue burnt. Any dead scales should also be removed. In dry weather it is permissible to scrape out canker patches until the latex just begins to flow, and then leave the remainder to be corked out naturally, but in wet weather all the diseased tissues should be removed. After excision the patches can with advantage be brushed over with Brunolinum solution. We have now discarded the view that the patches should be covered with cowdung and clay, as recent experiments have not shown any advantage in bark renewal from the use of that mixture. We have frequently been asked whether it would not be advisable to apply the tar and tallow mixture after cutting out. The great objection to the use of tar in Ceylon arose as a result of experience with cacao canker. It was then found that if tar was used, the coolies tarred the canker patches without cutting out, or without completely cutting out the diseased tissue and the disease continued to flourish underneath the tar and spread to other parts of the stem. There is no objection to the use of tar and tallow if one can be certain that all the diseased tissue is cut out, but in the light of previous experience, it would appear safer not to tar. When wounds extend to the wood, the exposed surface should be tarred completely, right up to the edge of the cortex; it has proved more important to protect the wood from borers and fungi than to consider the most rapid method of healing the wound. It has become a common practice to protect the tapped surface by covering it with tar and tallow. This may diminish the chances of infection, though it does not appear to be applied frequently enough and so the part most liable to infection is generally exposed. The fruit and leaf disease is more difficult to tackle

than the stem disease. But the fruits are the main source of the spores which infect the stem and it is therefore important that the fruit disease should be dealt with as far as is possible. Spraying may be said to be out of the question. Diseased fruits, especially of those which remain hanging on the tree, should be collected and burnt. MACRAE has determined that the fungus is carried over the dry season in the dead branches, and, therefore, all dead branches should be pruned off, a few inches behind the dead part, and burnt. These dead branches start the infection of the fruits in the following year. Branches die back from many causes, and consequently, in pruning off dead branches many will be removed which do not harbour the canker fungus as it is not possible to distinguish between them in the field. This is a difficulty which cannot be avoided. The fruit stalk of rotted fruits are another possible source of infection. Experiments are to be made next year with a view to removing the fruit before the monsoon sets in. It is possible that this could be done, at least on the lower branches, though whether it will prove too costly remains to be seen. Anything which will lessen the number of fruits will diminish the probability of extensive leaf fall, stem canker and bark rot. Our knowledge of the fungus is now fairly complete, but we require more information concerning the distribution of the disease. It is possible that detailed records of distribution may give us some hint on possible methods of dealing with it. I would ask, therefore, that every superintendent of a rubber estate would be good enough to inform me by letter:

(1) Whether pod disease has occurred on the estate this year;

(2) Whether the attack was severe or light;

(3) Was there any noticeable difference between different fields on the estate in this respect?

(4) Can this difference be associated with any difference in manuring, soil elevation, etc.?

## RUBBER GATHERING IN SIERRA LEONE.

A curious and interesting method of collecting *Funtumia elastica* rubber in Sierra Leone is described in a book recently written by O. H. NEWLAND, Director of the Peneiro Rubber Estates, Limited.

The natives fell the tree and cover it with dry grass, which is set on fire. The heat generated is just sufficient to cause a practical coagulation of the latex in the lactiferous vessels. The bark is then bruised off by pounding with stones, and the debris taken down to the river and washed thoroughly to separate the bark from the rubber. The separation is seldom complete, and the result is a dirty rubber, fetching 2*s*. (48 cents) per pound.

This primitive method, however, is not universal in Sierra Leone. The more intelligent natives ascend the trunk of the standing tree by means of a sling passed around the trunk. One end of the sling is provided with a loop which fits over the right thigh. The worker keeps his left foot on the sling and thus, by moving the rope up the tree the ascent is rapidly accomplished and when the desired point is reached, both hands are free to make the tapping.

The climber carries a chisel with which he cuts vertical as well as transverse oblique grooves, forming a rough "herring bone" pattern, which

may be continued the whole length of the trunk, and even extend up to the main branches. The flow of latex commences at once, and follows the vertical channel into a calabash placed at the base of the tree, being guided by means of a lip of clay or a chip of wood. The quantity of latex procured at one tapping varies from a pint to two quarts per tree. After each tapping the tree is allowed to rest several months, during which the wounds heal. On the second tapping the same form of cut is made upon the opposite side of the tree, and the transverse channels often intersect those made previously.

In gathering the vine rubber of the *Landolphia owariensis* the natives add lime juice to hasten coagulation when it is necessary to do so. Usually, however, the *Landolphia* latex coagulates in the tapping wound almost immediately upon exposure to the air. Ofttimes the collector merely smears the fresh latex upon his naked body, until enough has been coagulated to be stripped off and formed into a small ball, which serves as a nucleus for winding on the strips of fresh latex, as the new cuts are made.—INDIA RUBBER WORLD.

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## ON THE COAGULATION OF *HEVEA* LATEX AND A NEW METHOD OF COAGULATION.

B. J. EATON AND J. GRANTHAM.

When latex is allowed to coagulate spontaneously in open vessels, a peculiar slime or yellow scum forms on the surface. This surface scum is alkaline in action while the serum below is acid, thus showing two distinct processes of decomposition, viz., an alkaline aerobic process and an acid anaerobic process. This latter is the basis of a patent anaerobic process of coagulation in which the latex is allowed to coagulate in tall cylinders so as to reduce the amount of aerobic decomposition.

Latex sterilised in an autoclave at 140°–150°C. remained uncoagulated after several days under sterile conditions, but on exposure to air or after inoculation with a little fresh latex, coagulation set in after 24 hours, showing that coagulation is dependent upon bacterial decomposition.

Latex heated to 90°–100°C. and kept under sterile conditions coagulates spontaneously without putrefactive change, the serum becoming slightly acid. Putrefaction, however, sets in later.

The writers conclude from these results that coagulation is not due to an enzyme but to bacterial action of a non-putrefactive nature.

There are therefore two kinds of bacteria capable of developing in latex according to the conditions, the putrefactive organisms being inhibited at a lower temperature than the non-putrefactive organisms.

Experiments were then made to increase the activity of the non-putrefactive organisms by the addition of sugars and it was found that the addition of 0·2 per cent. of dextrose brought about coagulation in 18 hours, the whole of the dextrose being completely decomposed. The addition of dextrose to sterile latex did not bring about coagulation.

Coagulation under anaerobic conditions is not uniform, since it depends on the constituents of the latex. This method, therefore, does not give a rubber of uniform quality.—BULL. INTERNAT. INST. OF AGRIC.

# PLANTATION RUBBER IN COCHIN CHINA.

LAWRENCE P. BRIGGS.

The production of plantation rubber is a comparatively new industry in Cochin China. Several years after Ceylon, Java, Sumatra and the Federated Malay States were producing rubber in considerable quantities, it was thought that Cochin China lacked the requisite soil and climate for the successful cultivation of the rubber tree. The first real plantation was established in 1900. In 1908 the first plantation rubber was exported from Saigon. About this time several large plantations were established. In 1915 the port of Saigon exported over 350,000 kilos of plantation rubber with a customs valuation of over 300,000 ( United States Currency ), but with a market price nearly twice that figure. On the first of January, 1916, there were in Cochin China about 100 plantations, with a total of nearly 70,000 hectares * and over five million trees, of which only about 400,000 have yet been tapped. It needs only the normal exploitation of the trees already planted to make plantation rubber in 1920 second in value to rice among the exports from Saigon.

## WILD RUBBER.

For many years Saigon has exported native rubber—years ago in much greater quantities than now. This rubber was brought from the forests of Cambodia and Laos by natives, who obtained it from several varieties of wild trees and tropical lianes, especially the Ecdysanthera glandulifera. These lianes are tapped by making, with a knife or other sharp instrument, longitudinal slits in their vine like trunks, in which the latex or sap is coagulated. After coagulation these strips of rubber are smoked on the tree, then rolled into a ball. This trade has declined greatly during the past few years partly because the easily available trees were nearly ruined during the years of high price and partly because from 1912 until recently the price has not been sufficiently great to make it worth while to transport this product the necessary distance. The exportation of native rubber during the years 1899-1915, inclusive, has been as follows :—

| Year. | United States | | Year. | United States. | |
|---|---|---|---|---|---|
| | Kilos. | Currency. $. | | Kilos. | Currency. $. |
| 1899 ... | 1,513 | 722 | 1908 ... | 10,414 | 13,057 |
| 1900 ... | 39,491 | 37,688 | 1909 ... | 3,085 | 2,679 |
| 1901 ... | 76,326 | 97,688 | 1910 ... | 9,125 | 7,925 |
| 1902 ... | 14,767 | 18,525 | 1911 ... | 67,995 | 59,053 |
| 1903 ... | 7,692 | 9,649 | 1912 ... | 70,052 | 60,841 |
| 1904 ... | 12,848 | 16,118 | 1913 ... | 63 224 | 54,910 |
| 1905 ... | 37,724 | 47,325 | 1914 ... | 7,233 | 6,282 |
| 1906 ... | 57,443 | 84,607 | 1915 ... | 5,778 | 5,018 |
| 1907 ... | 34,137 | 42,825 | | | |

## BEGINNINGS OF PLANTATION RUBBER 1880-1907.

There is some dispute about the exact time and place of the introduction of plantation rubber *(Hevea Brasiliensis )* into Cochin China. Old pioneers recall that a few rubber trees were planted in the Botanical Gardens at Saigon in 1880 or 1881, but these trees seem to have disappeared within four or five years from that date. According to the best authorities the rubber tree was

* Hectare = 2·47 acres.

permanently introduced into Cochin China in 1897 by M. RAOUL, chief pharmacist for the Colonies. During a visit to Ceylon this official sent to the Saigon Botanical Gardens several thousand seeds. From these seeds about 1,800 plants appeared in 1898. In October of that year, 1,000 plants were sent to the Government Experimental Station at Ong-Yem in Cochin China, 200 were sent to DR. YERSIN, director of the Pasteur Institute at Nha Trang in southern Annam, and a few hundred were distributed among the various planters of Cochin China.

The rubber plantation at the Ong-Yem experimental station still continues. Less than 400 of the original trees survive, but new plantings on this and the adjoining plantation of the House of Correction raise the present number of trees to 16,500. The joint production of these two plantations for 1914 and 1915 is said to be about 3,700 and 6,000 kilos, respectively. DR. YERSIN'S plantation at Suoi Giao near Nha Trang is more extensive. This plantation now consists of about 60,000 trees. Its production during the various years since tapping began is shown in later pages of this report.

The next year (1899) several thousand seeds were imported from Ceylon and the plants were distributed among various planters. The first successful plantation was established by M. FRANCOIS BELLAND, at that time chief of the Saigon police. In 1900, this colonist planted 600 trees on his plantation at Phu Nhuan, about three miles from Saigon. The next year he planted 4,500 more, and in 1902 another 900. This plantation, with that of Hanh-thong-tay a few miles away, purchased later by M. BELLAND, contains about 25,000 trees. The first tapping in 1908, yielded about 1,500 kilos of rubber. This amount has been gradually increased, especially during the past two or three years. Nearly all the plantation rubber exported from Saigon before 1913 came from the Belland plantations.

## DEVELOPMENT OF RUBBER PLANTATIONS 1907-1916.

The plantations at Phu-Nhuan and Ong Yem were located on the narrow strip of gray soil which marks the first elevation from the delta-lands and flood-plains of which lower Cochin China is composed. Above this gray strip lies a wider strip of red soil of volcanic origin and of remarkable fertility and depth, reaching in some places 20 or 30 feet. This strip, about 35 miles wide, begins in the upper end of the province of Baria and extends 60 or 70 miles north-northwest across the provinces of Bien Hoa and Thudaumot and into the Protectorate of Cambodia.

In 1907 and 1908 two companies were organised to make more ambitious attempts to cultivate *Hevea Brasiliensis* on plantations located within the red soil area. In the former year the Societe Agroicole de Suzannah was organised with a capital stock of 2,500,000 francs,§ divided into 10,000 shares of 250 francs each. The same year this company planted 700 trees on their plantation near the station of Dau Giay on the Saigon-Nha Trang railway in the province of Bien Hoa, about 45 miles east of Saigon. The number of trees was increased to 45,000 in 1907, 140,000 in 1909 to 300,000 in 1910. The first tapping took place in 1912, when the production amounted to 4,480 kilos. In 1913 this plantation produced over 24,000 kilos of rubber. Since that time it has been, next to XaTrach, the most productive rubber plantation in Cochin China.

§ Franc = 23·8 cents.

In 1909 the Societe Anonyme des Plantations d'Heveas de XaTrach was formed with a capital stock of 2,300,000 francs and purçhased a plantation at XaTrach, about 65 miles north of Saigon, in the province of Thudaumot. The first year 100,000 trees were planted. This number was increased to 200,000 in 1909 and 250,000 by 1915. In 1911, 540 trees were tapped; in 1912, 15,300, and in 1913, 54,000. The production of this plantation during the latter year was 25,170 kilos. It has since remained the most productive of the Cochin China rubber estates.

The years 1908 and 1909 witnessed the creation of two large plantations on the gray soil strip near Saigon. In the former year the Societe des Heveas de Tay Ninh planted about 8,500 trees in the province of the same name, about 40 miles west of Saigon. In the latter year the Societe des Heveas de Tan-thanh-dong planted about 55,000 trees on their plantation in the province Giadinh, a few miles distant fron the capital. Although the development of these plantations has been slower than that of those in the red-clay strip, the figures given in later pages of this report show them to be among the most important plantations of the colony.

The four following years (1909-1913 inclusive) saw the formation of many companies and the rapid absorption of the best available lands for rubber cultivation. The most important of the companies formed at this time is the Societe des Caoutchoucs de l'Indochine. This company, controlled by the Banque de l'Indo-chine has a capital of 4,500,000 francs and its head-quarters at Paris. Its plantation is located at Loc Ninh in the red soil district, a few miles beyond Xa Trach. Besides being considerably the most ambitious attempt at rubber cultivation in Cochin China, this plantation is notable as being the first successful attempt to interest, on a large scale, the capital of the mother country, the earlier plantations being controlled almost entirely by local capital.

By the year 1913 the rubber industry can be said to have become firmly established in Cochin China. By this time the total surface planted to rubber trees amounted to about 14,000 hectares, the number of trees planted was over 4,000,000 and the capital invested not less than $ 5,000,000. In this year the older estates were beginning to yield and the exportation rose to about 85,000 kilograms. †

The next three years, 1913-1915, inclusive, saw the development of old plantations rather than the creation of new ones. This was partly due at first to the decline in the price of rubber, partly to the fact that the most available lands had been taken up and partly, later, to the war. But the productivity of the later large estates is just beginning to assert itself. On January 1, 1916, there were in Cochin China and adjacent territory in Annam and Cambodia over 70,000 hectares in rubber plantations, of which over 17,000 hectares were planted to over 5,000,000 trees. Over 400,000 trees had been tapped, about 440,000 more were to be tapped during 1916, and the production for 1916 was estimated at over 700,000 kilos. The amount of capital invested is placed at more than $ 6,000,000.

## CHOOSING A RUBBER PLANTATION IN COCHIN CHINA: CLIMATE, SOIL.

In beginning a rubber plantation the first step is to choose a location, the second to get possession of the land. In choosing a location the primary

† Kilogram = 2·2 pound.

questions are those of climate and soil. Transportation, difficulty of clearing the land and the labour problem are questions to be solved later.

The question of the right amount of water is an important one in Cochin China. The plantation must have sufficient elevation to avoid the annual floods of the delta region and to afford quick drainage after the annual rains. Many of the trees first planted at Ong-Yem were drowned out during the wet season. On the other hand, the extreme dryness of the years 1911 and 1912 wrought serious handicap to those plantations where irrigation was impossible or insufficient. Then, temperature seems to count for something. There is a point along the coast of Indo-China above which the rubber cannot be successfully cultivated. This point seems to be about the 13th parallel north latitude, just north of Nha Trang. The only plantations above this line are those of Delignon Freres near Qui Nhon, in Annam, about 14 degrees north, and still in the experimental stage. Another peril along the coast of Annam is the typhoon. The typhoons of 1909 and 1912 seriously damaged the plantation of Suoi Giao near Nha Trang.

Experiments show the soil of Cochin China to be well adapted to the growth of the rubber tree. A physical analysis made in the laboratory of the Saigon Botanical Gardens of the red lands of Bien Hoa at 100 degrees shows the following compositions :—

| | |
|---|---|
| Sand ... ... ... ... | 478·40 |
| Clay ... ... ... ... | 438·19 |
| Organic matter ... ... ... | 67·72 |
| Ferruginous gravel ... ... ... | 7·15 |
| Carbonate of lime ... ... ... | 6·16 |
| Vegetable mould ... ... ... | 2·38 |
| | 1,000·00 |

Chemical analysis of this soil made of the same time and under the same conditions shows the chemical composition indicated in the first column of the following table. The other columns show the composition of red soil taken from plantations in the province of Thudaumot (Xa Trach) and Baria (Arcillon) and an average of seven analyses taken fron various parts of Cochin China :—

| | Bien Hoa. | Thudaumot. | Baria. | Average of 7 Analyses. |
|---|---|---|---|---|
| Nitrogen ... ... | 1·81 | 1·33 | ·92 | 1·01 |
| Phosphoric Acid ... | 6·70 | 1·65 | 5·21 | 7·22 |
| Potash .. ... | 1·02 | 1·10 | ·59 | ·62 |
| Lime ... ... | 3·44 | ·50 | ·25 | ·75 |
| Magnesia ... ... | 2·49 | ·35 | ·59 | ·39 |

An analysis under the same conditions of the gray sandy soil of the older plantations shows the following composition :—

| | Province of Giadinh Plantation. | | Thudaumot Ong-Yem. |
|---|---|---|---|
| | Josselme. | Thudnc. | |
| Nitrogen ... ... | ·557 | 9·310 | ·404 |
| Phosphoric acid ... ... | ·159 | ·107 | ·347 |
| Potash ... ... | ·510 | ·796 | ·510 |
| Lime ... ... | ·420 | ·644 | ·196 |
| Magnesia ... ... | ·550 | ·350 | ·100 |

These analyses show the red soil to be very rich in phosphoric acid,

above the average in nitrogen, but sometimes slightly deficient in potash, lime and magnesia. These deficiencies may be supplied by the occasional use of a small amount of artificial fertilizers. The gray solids, on the other hand, have an abundance of potash, lime and magnesia, but are wanting in nitrogen and phosphoric acid. The lacking substances have been supplied by the application of stable manure and oil cakes.

In practice the red soil has proven richer in the elements necessary for the development of the rubber tree, and colonists who are able to choose are locating their plantations in the red soil strip.—India Rubber World.

## STARCH AS AN ADULTERANT.

A note on the adulteration of rubber with starch has been inserted by Mr. B. J. Eaton in the Agricultural Bulletin of the F.M.S. Starch, in the form of tapioca or sago, which is easily obtainable locally, is probably used sometimes by contractors' tapping coolies on estates where contract tapping exists. The managers of such estates pay on the wet weight of rubber collected, making an allowance for the water content of the sheet rubber obtained, the sheets being weighed sometimes after being machined and hung to drain. If starch be used as an adulterant, it absorbs a large proportion of water, and the manager pays not only for the added starch, but for water, since the wet sheets, on drying, lose much more weight than would normally be allowed for.

Mr. Eaton has examined a sample taken from the middle of a parcel from Johore, consigned to Singapore, and sold at the auctions there by a Chinese vendor. It consisted of a thin sheet having the appearance of a piece of drab-coloured leather or hide, and was easily torn, revealing a pure white interior, resembling flour. The sample is actually the first in which starch has been discovered, although two suspected samples from another estate were examined a short time ago.

The history of the sample does not indicate whether the adulteration was practised for the reason suggested above, or whether it is an actual case of adulteration by the owner of the estate and vendor of the rubber, but the large amount of starch left in the dry rubber would suggest that the adulterant was added deliberately for selling purposes.

It was found impossible to estimate the starch by washing it out on a crepeing machine, since the rubber refused to cohere on crepeing, and became a mass of crumbs, the particles being washed through the sieves below the crepeing machine and lost; but by boiling the rubber in dilute hydrochloric acid and subsequently in pure water, and by crepeing it on a small experimental crepeing machine with hot water, a fairly coherent sample was obtained, which could be subsequently creped and washed with cold water on the ordinary factory crepeing machine, and converted into thin crepe on a factory sheeting machine. Even after this treatment, the rubber resembled lace and was very weak. The loss on treatment, which probably consisted almost entirely of starch, was 50·9 per cent.

In future, planters who may be employing contract tappers will be well advised to look out for adulteration of this nature. It would probably be easily detected in sheet rubber when dry, but not in crepe, since the starch

would probably be almost entirely removed on the crepeing machine, when fresh coagulum is washed. A very simple test for identifying the presence of starch, although not the origin of such starch, is to add a few drops of a dilute solution of iodine to the suspected sample of rubber or latex, when a blue colour will be produced.—INDIA RUBBER JOURNAL.

## RUBBER PLANTING IN MALAYA.

M. PIERRE DE BONDY has kindly forwarded for our perusal a pamphlet entitled "Rubber Planting in Malaya," which is actually an estimate of opening up an estate of 2,000 acres in four years at the rate of 500 acres per annum, with details of the total expenditure thereafter up to the seventeenth year, inclusive, showing the cost of production per pound of rubber, and the profits, the latter being based on a selling price of one shilling and six pence per lb.

We note that the total cost of bringing the estate into bearing, i.e. up to the end of the first five years, after which the first 500 acres will be tappable, is estimated at 463,015 dollars, or 230 dollars per acre.

The most interesting feature of the estimate, however, to Ceylon readers, is the tapping scheme set out in this pamphlet, in so far as it may to some extent illustrate the views of Malayan planters on this much debated question. The author adopts a system of tapping on quarters with a four years' renewal. For the first four years, the trees are to be tapped by two cuts on a quarter at eighteen inches apart daily, the four quarters being tapped out in four years, giving a bark consumption of eighteen inches (per cut) per annum. For the next four years, the same quarters are to be tapped on first renewal bark, but with three cuts, at twelve inches apart, on alternate days,—a bark consumption of twelve inches per annum. And the same system is to be adopted during the third period of four years on the second renewal bark, and apparently repeated *ad infinitum*.

Conditions in Malaya may, no doubt do, differ from those in Ceylon. Nevertheless, we would venture to suggest that the consumption of bark is excessive, and that it is very doubtful whether a system based on a four years' renewal can be continued indefinitely. Furthermore, facts are now emerging from the hitherto conflicting results of tapping experiments, and there are many records which show that little is gained by multiplying the number of cuts, that the renewal after daily tapping is poor, and that though daily tapping gives more rubber than alternate day tapping it is not economical. It is always unsafe to prophesy, yet we would hazard the opinion that, with rubber at a low price, estates will find it more profitable to adopt a system based on one cut, and alternate day or three-day tapping.—T. P.

## DEVELOPMENT OF RUBBER CULTIVATION IN BURMA.

As a result of discussion at the beginning of the year between the Lieutenant-Governor of Burma and representatives of the Lower Burma Planters' Association, the rules regulating grants and assessments of land for rubber cultivation in Burma have been considerably modified. The rubber

planters represented that the extension of rubber growing was being hindered by the liability of rubber estates leased under the rules then in force in Lower Burma to a land revenue assessment which might rise to as much as Rs. 25 an acre. Accordingly, a revision of the rules was agreed to, providing for the issue of grants instead of leases, and the levy of royalty on the net value of rubber, combined with a moderate revenue assessment, instead of the previous liability to land revenue, the rates of assessment to be reconsidered every twenty years. A committee consisting of the Financial Commissioner of Burma and representatives of the Lower Burma Planters' Association drafted these new regulations, which were accepted by the Lieutenant-Governor and duly promulgated. Their recommendations included the following:—Land for rubber cultivation to be granted in perpetuity, subject to payment of the annual land revenue assessment and the royalty on the net value of rubber produced and exported; exemption from land revenue to be granted for the first eight years of occupation; land revenue and royalty to be levied at the rate of Rs. 3 per acre and 2 per cent. respectively for twenty years; grants to prescribe that one-tenth of the total area granted must be planted with rubber trees within two years of the grant, one-half within four years, and three-fourths within eight years. The new rules affect only land granted for rubber cultivation on and after July 1st, 1916; for land granted or leased under previous rules certain abatements of royalty and land revenue assessments are allowed, and owners are offered the opportunity of surrendering their land at any time in the next ten years, and of taking out a grant under the new rules. The following table shows the area under rubber cultivation in Burma and the amount exported in the past five years, as given in the Report on the Maritime Trade and Customs Administration of Burma:—

| Year | Acres. | lb. |
|---|---|---|
| 1911-12 | 32,772 | 310,240 |
| 1912-13 | 44,029 | 526,176 |
| 1913-14 | 50,946 | 765,072 |
| 1914-15 | 57,785 | 987,392 |
| 1915-16 | 57,843 | 1,285,984 |

Experience shows that large areas in Burma are suitable for rubber cultivation, and the committee considers that an estate in full bearing should yield not less than 350 to 400 lb. of rubber per acre.—India Rubber Journal.

## THE GIPSY MOTH.

P. S. BUNKER.

The most effective single feature in the suppression of the gipsy moth (*Lymantria dispar*) is the thinning out of non-resistant trees, such as oak, grey birch, etc., upon which the larvæ feed in early stages. Since dispersal is brought about by mechanical transport and by wind, it is essential that colonies should not be allowed to develop in hedges, fields, etc. The removal of non-resistant trees from roadsides and adjoining private property to a distance of from 25 to 50 feet from the road was carried out on a large scale during 1915, and resulted in about 90 per cent. reduction of infestation in residential, business and suburban districts. This measure was supplemented by the collection of egg-masses and spraying in the most seriously infested localities.—Review of Applied Entomology.

# TOBACCO.

## VARIETIES AND SEED SELECTION OF TOBACCO IN THE PHILIPPINES.

In most other important tobacco regions of the world the question of pure strains and great uniformity among the individual plants of a crop have become of the highest commercial importance. All possible means are employed to secure and to maintain the purity of the strains grown. No attention whatever is given to this matter by the common farmer in the Cagayan Valley. Almost every vega presents a most heterogeneous mixture of varieties. In some cases this only becomes evident on careful examination, while in other cases it is strikingly conspicuous. It is perfectly evident to any one trained in modern tobacco work that greater uniformity in the character of the crop produced will be utterly impossible without a large amount of expert attention being given to this matter. What is perhaps the commonest type in the valley is termed *Espada*, the leaf being long in proportion to its width and having a long extended apex. The bulk of the best fillers from the province of Cagayan are produced by this type. Another common type is the *Viscaya* which has a somewhat broader leaf blade and a naked petiole. Another variety called *Pampano* has a leaf of Havana type, very broad in proportion to its width, the apex retracted, and the petiole short and broadly winged. Some of the finest wrappers produced in the valley come from these two last named types. Still another very well-marked variety may be commonly encountered in the vegas although rarely grown in anything even approaching pure culture. This tobacco is termed *Romero*. It possesses thick and rather coarse leaves characteristically arranged on the stem, and produces a highly aromatic tobacco of peculiar quality. Of course, it must be understood that under each one of these general types there may be included a vast assemblage of widely variable individual forms. In other words, under any one of the well-recognized varieties, there may be everything ranging from ideal forms to plants of very undesirable character. In addition to this, and of very frequent occurrence in the vegas, there are a great variety of pathological forms, all of which are, of course, very undesirable. These include forms possessing a variety of malformations, such as strap-shaped leaves, bent and deformed veins, and bladdery or otherwise deformed leaf surface. Of great frequency in all the vegas examined are various diseased conditions of the plant, which may be grouped under the general head of chlorosis. The extreme seriousness of the whole matter of varieties and forms may be appreciated when it is stated that most of these characteristics mentioned are heritable, and that the practice of topping is not nearly as common in the valley as it should be. The plants are commonly allowed to flower freely, thus giving the fullest opportunity for the transfer of pollen from one plant to another. Wholesale mixture is thus taking place every year under such a system—or rather, lack of system. It is impossible for any veguero in the valley to have anything

like a pure planting, while on the other hand it is entirely probable that he will continue to have about the same proportions of mixture and the same proportions of very undesirable pathological forms. It is a well-known fact that in the most progressive tobacco regions of the world the work of seed selection is highly developed and the results therefrom of great commercial value. The methods used are exceedingly simple. Desirable types of plants are selected during the growing season and when the flower head is forming, but before any of the flowers have opened, large paper bags are securely tied over the entire flower cluster. This compels the plant to use its own pollen fertilization of its flowers and production of seeds, or, in other words, to inbreed. Tobacco is quite remarkable among agricultural crops in that it adapts itself to this inbreeding without suffering any ill effects therefrom. Seed from these inbred plants commonly yield progeny of striking similarity to the parent, and the outcome of such work, when intelligently and systematically undertaken along well-advised lines, is of the highest possible value in securing a high degree of uniformity in the crop and in the quality of the leaf produced. It is now extensively employed in the most progressive tobacco regions of the world. Except as a result of the very limited and consequently ineffective efforts of the Bureau of Agriculture, this work is practically unknown among the farmers of the Cagayan Valley. The Bureau of Agriculture employees have attempted to instruct some of the more intelligent farmers in this method. The utter futility of such an attempt is indicated by the fact that we found one farmer carefully adjusting a sack on a plant the majority of the flowers of which were already open.

## CULTURE.

The seed-bed methods employed by the people are exceedingly primitive, give little or no protection from severe storms, and cannot possibly give any reasonable uniformity in planting stock. It is a comparatively easy matter to prepare well-protected seed beds, calculated to withstand even the destructive force of a typhoon and thus prevent the serious losses that occur almost yearly. During the past season, almost all of the first seed beds prepared were lost. Many of the farmers had used all of their seed in the first planting and had great difficulty in obtaining additional supplies, and this is saying nothing of the losses occasioned by long delay in planting. It is a well-known fact that the earliest plantings yield the best tobacco and that there is little to expect from plantings made as late as January and February. The widespread losses of seed beds during the past season caused delays in many parts of the valley that reached into January and February, and without exception these later plantings have produced most unsatisfactory results. The matter of care and security in connection with seed-bed work is thus of the highest possible importance to the planter.

In some parts of the valley delays in planting and lack of proper cultivation with proper tools produced conditions that seem to call for irrigation and under such conditions attempts at irrigation have given very good results. It is entirely probable, however, that with early planting and thorough cultivation, irrigation would be unnecessary even in very dry years. This also will be a matter for experimental trial and demonstration.

A great influence on methods of culture in the valley has been exerted by the widespread idea that size of leaf and quality are synonymous. This idea seems to have come down from the earlier days of tobacco planting in

the valley, so that at the present time size is one of the fundamental considerations in the classifications of the valley tobacco. It would probably be incomprehensible to the common farmer in the Cagayan Valley that the tobaccos of the world bringing the highest prices per kilo are small-leaved tobaccos. In the valley a leaf of a meter or more in length is very greatly admired. It is, of course, true that if the tobacco is to be measured by number of leaves then there will be a great deal more tobacco if the leaves are large. The finest wrapper leaves seen by us in the valley range from 40 to 60 centimeters in length, which is a very good size for wrapper leaves. The general desire among the farmers to produce a large leaf has led them to adopt wide spacing as a general practice, thus giving the plants opportunity for maximum development. This practice, however, is not favourable to the production of large percentages of fine wrapper under the conditions existing in the valley. The common distance of planting is about 1 meter apart from row to row, and 70 centimeters from plant to plant. At this distance the plant enjoys the optimum conditions as to food supply and sunshine and the maximum development of the plant occurs, favouring quantity rather than quality. It must be remembered always, in this connection, that the primary object in the valley is the growing of cigar and cigarette tobaccos. The tobacco plant possesses the most extraordinary sensitiveness to light conditions, and great differences in the product may occur through apparently slight differences in the amount of sunlight which reaches the leaves of the plant. This was discovered very long ago in the Cuban tobacco districts. Cuban planters found that closer planting resulted in far greater fineness of leaf and delicacy of flavour. They also found that additional cutting off of the direct sunlight still further heightened this effect, as, for instance, when tobacco was planted in very open and scattering plantations of fruit trees or of bananas. So, to-day, in some of the best vegas of Cuba one will find fruit trees and bananas scattered through the tobacco fields in greater or less numbers. Understanding well these effects, the Cubans were very ready to adopt the use of cheesecloth tents for the production of the finest and most uniform grades of wrapper. It should, however, be well understood that cheesecloth tents are not necessary for the production of large quantities of high grade wrapper in Cuba, for this was accomplished anterior to the introduction of tents. In the work at Los Banos the College of Agriculture has made an extensive use of the old Cuban methods involving closer planting, or partial natural shading, and tried out side by side with this, planting under cheesecloth tents by the most approved methods. Both methods were successful in producing fine wrapper, approved by all tobacco men who examined it. If there was any advantage either way it was with the leaf produced outside of the tent. In addition to this there must be taken into consideration the very large expense involved in the building of the tents. On the other hand, it must be fairly recognized that no comprehensive and adequate experiments with growing tobacco under cloth have ever been carried out in the Philippine Islands. Such attempts as have ever been made in the Cagayan Valley have been confined to wholly inadequate first attempts which were not followed up. The fact that this method has proven a commercial success in many other parts of the world certainly amply justifies further experimentation along this line in the Philippine Islands. It is doubtful if anything worth while could be accomplished with this method under the existing labour conditions in the valley

but, as the years go by the method should be exhaustively tried out here so that when favourable conditions do exist it may possibly be put into practice. In the meantime, we do know that fine wrapper can be produced in the open fields, and the entire probability is that with seed selection, somewhat closer spacing, and greater care in curing, it will be possible to fill all of our present demands for wrapper. Three to five years of systematic experimentation will serve to determine fully the possibilities in this direction.—Joint Report on the Economic and Agronomic Conditions in the Cagayan Valley in Relation to Tobacco.

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# TESTING OF AGRICULTURAL SEEDS IN SOUTH AUSTRALIA.

K. W. ANDREW.

Under the Federal Quarantine Act, the introduction into the Commonwealth of seeds or plants of over 140 species of noxious weeds is absolutely prohibited. Under the Federal Commerce Act, seeds imported must be true to name, and sound, fresh and clean, although no standard has so far been set up and discretion is allowed the Customs as to what constitutes quality in this respect.

In the case of South Australia, samples of all agricultural seeds imported from abroad are taken at Port Adelaide, the Outer Harbour and the General Post Office, Adelaide, by officers of this Department acting as Quarantine officers for plants, and submitted to another officer in this office who examines them to see what weed seeds they contain, and the quality of the consignment is gauged after germination tests have been made. Where any doubt exists as to whether they are suitable seeds to admit into the State, the Chief Quarantine officer for Plants for South Australia exercises powers conferred upon him under these Acts, and issues instructions for the goods to be freed (where practicable) of impurities, or to be destroyed, or returned, to the country of origin.

The results of purity tests are not given (as in most seed laboratories) in the percentage of impurities, but the method adopted is the same as that practised in Canada; the number of weeds per unit weight of sample being given.

The germination tests are made in duplicate (two lots of 100 seeds each). Bull. Internat. Inst. of Agric.

# SUGAR-CANE.

## THE WORLD'S SUGAR SUPPLY.

After Cuba comes India. India is thought to be the native home of the sugar-cane. It has been grown there from time immemorial and has been treasured by the natives as a household crop, as dear to the native East Indian as is the pig to his Irish owner in the Emerald Isle.

The exploitation of the sugar industry in Cuba is now fairly under way and the next decade will develop wonderful advancement in that strangely excellent Island for cane sugar production. There seems to be no parallel to it except in the Far East, where, in the island of Java some years back, with a production of a million and a quarter tons of cane sugar, Java led the rest of the cane sugar world in the magnitude of its industry, always omitting India, where the sugar produced in the country does not enter into the commerce of the world and now has only become known in all its magnitude through the civil control exercised by the English Government throughout its East Indian Colonies and possessions.

Before advancing much further into the subject it might be well to say that in Southern India the sugar-cane grows to splendid proportions, showing as it does the adaptation of the cane crop to the lands, the fertility of the soil and the excellence of the climate for sugar-cane production. On the other hand, the more northerly provinces in India are said to produce far more sugar as a total production than is done in Southern India. It is said, further by those who are writing on the subject in the Indian journals, that this more northern country, less well adapted to sugar-cane, produces somewhat indifferent cane, but canes that ripen comparatively early, which have a rather short season of active growing life and are such canes as have survived in those latitudes just outside the tropics during many centuries of the past.

Apart from China, India shows the largest aggregation of people in the world, some 360 millions under one Government. The 400 millions of population dominated by the Chinese Government have never devoted themselves to the sugar industry to anything like the extent given to this cultivation in India, and be the situation in any country, what it may, its condition is at once evidence of its advantages or disadvantages, either in climate, soil or government.

This leads us to believe that not many years hence, and especially under the impulse to be given to such investigation by the English people, there will be speedy interest excited in the production of cane sugar in India. As it stands even now, with a production of some $2\frac{1}{2}$ millions of tons of common open train sugar, India imports from other countries various kinds of sugars aggregating some 800,000 tons. With a teeming population, with labourers with which England has been willing in the past to supply the British West Indies to whatever extent the sugar planters there thought necessary, India is apparently without any thoroughly good organisation, any carefully laid plans

looking not only to the securing of an adequate sugar supply for the home consumption in all of British India, but to become the source of supply and the main sugar dependence of the British nation.

Java, a volcanic island under the control of the Dutch Government, now produces from a million and a quarter to a million and a third long tons of sugar every year. Several causes have led to this. The investigations into plant life by the beet growers of Central Europe have led to the application of the same research work to the fertile lands of the Dutch East Indies and there, in a wild and mountainous country, with a native population not particularly given to work, the Dutch Government has realized an enormous industrial success. It would seem far easier to realize similar success over on the mainland in British India, but while it is realized to a limited extent, it never yet has led them to the point when India sugars have become exportable to any extent. All the sugar produced in India is eaten at home.

In a large part of British India rice culture is the dominant culture and these far eastern people, set in their ways, are always loth to change into any new culture. The splendid island of Ceylon years ago produced more than a million bags of high grade coffee per annum. The coffee trees were stricken with a disease which finally resulted in the practical destruction of coffee as a crop in that island. With the aid of the British Government the culture of the island was rapidly changed over into tea culture and Ceylon teas now are thought highly of all over the world and the present generation has almost forgotten that there ever was a notable crop of coffee in Ceylon.

The low lands of India may remain in rice culture for many years to come, but we are led to conclude that year by year these low lands will be better drained; they will be protected from the occasional floods; and the recognition of the fact that these low lands are always regarded as fertile will probably in the end carry many of them into cane culture. As matters move slowly in the Far East, this change in Indian agriculture may take a long time, and perhaps many generations of men to bring about. We must remember, however, that time flies more rapidly now than formerly, that the opportunities for securing wealth either by cultivating the land or by mining into the soil for diamonds, gold, silver, or oil, these and all of these methods are pursued based upon the evidence that they promise to attain final success.

The Cuba sugar industry hung on for two or more centuries with very little done in sugar production there, and yet now we find that during the last decade the increase in sugar production in Cuba is without parallel elsewhere in the world. Cuba has a large quantity of fine land, it has the great American market open to it by preference, it has American capital to back it up and finance it, and all these influences are making Cuba what it is and what it will be.

In the Far East one of the main features of the situation is that there is an ample supply of labour. To-day in the West Indies efforts are making to secure the consent of the British Government to continue the indenturing or apprenticing of the British East Indians to West Indian sugar planters to increase the sugar crops of the West Indies. While there may be no particular objection to this line of procedure, may there not be less difficulty if the same effort were made in the Far East to secure the development of the sugar-cane industry there, where the labour is native and plentiful.

It has been said, and probably truly said, that as sugar is now made in India one-fourth of the crop is lost in the bagasse by the lack of adequate cane juice extraction, the result of the common old-fashioned machinery in use. The great modern central factory, with its ponderous machinery turning out the bagasse so dry that it will readily burn at once and furnish all the fuel supply needed is accepted now as the *sine qua non* in cane sugar manufacture, and yet there is scarcely anything of the kind anywhere in India.

It has been said of the gold of California that every gold dollar mined there cost $1·25 to produce it and that the wealth of California lay in its wonderful lands and its great crops of wheat, fruits and other cultures. California has become rich because of its agricultural products and the production of gold carried the people there with its lottery of good and bad fortune, of which we have heard so many statements. Just so we believe that in British India there will be found enormous wealth, and the backbone of that wealth lies to-day in the splendid working populations, habituated to work, willing to work and to work for a moderate compensation. We might be led to think that after the war Great Britain, which is now looking so anxiously for her sugar supplies in the near future, will conceive some general plan for the development of the sugar industry in India, just as out in Australia the State of Queensland took the matter in hand for itself and developed there a sugar industry years ago amounting to a quarter of a million tons per annum. Cuba will soon reach five millions of tons of sugar as her annual product, and British India would only have to change over from her old-fashioned to the new-fashioned methods to make now, out of her own growing cane crops, as much sugar as Cuba now makes. The future of India lies for the present in the conversion of the sugar industry from the old farm crop with its soft gur sugar, over to a delivery of the necessary millions of tons of sugar-cane to great central factories to be turned out there in pure sugars, white and nearly white. This is already done in the English island of Mauritius. The whole question looks like an open book that every English Statesman could read. Why not foster their own industry in British India rather than to buy all their sugars from the beet sugar producers of Central Europe?—LOUISIANA PLANTER AND SUGAR MANUFACTURER.

## INDIAN TURMERIC.

In dealing with the question of cultivation and harvesting of turmeric in the AGRICULTURAL JOURNAL (October, 1915), published by the Department of Agriculture, Bihar and Orissa, MR. N. C. CHAUDHURI, Travelling Inspector of Agriculture, says: The total cost for cultivating an acre of land with turmeric, including the cost for preparation, amount to Rs. 78-2-0, or, roughly, Rs. 80. The wages for labourers are extremely cheap in this district, but, on the other hand, they do not take into account the cost of the manure and the labour of the members of a raiyat's own family. An average yield of a manured field may be estimated at 120 maunds per acre in green state or 24 maunds when dried. The average price per maund was Rs. 5 or Rs. 120 per acre, up till recent years, yielding a profit of Rs. 80 per acre. For the last three years, however, the price of turmeric has been as low as about Rs. 3 per maund. In that case there would be no profit if every item of the cost is calculated.—CHEMIST AND DRUGGIST.

# FIBRES.

## STEPS TAKEN TO PRESERVE *KOKIA ROCKI*, A WILD RELATIVE OF THE CULTIVATED COTTON PLANT IN HAWAII.

ROBERT A. YOUNG.

The rise of the science genetics has given breeders a keen realisation of the value of the wild relatives of important cultivated plants, although the former may be of no economic importance. This is the case with regard to a tree growing wild on Hawaii, and called "Kokio" by the natives, *Gossypium drynarioides* by SEEMAN, and *Kokia Rocki* by LEWTON. This tree was threatened with absolute extinction and was only saved by the exertions of the Office of Foreign Seed and Plant Introduction of the United States Department of Agriculture. The writer states that about 80 per cent. of the native flora of the Hawaiian Islands is endemic and, therefore, it is of the greatest importance that these species should be preserved. Some "Kokio" trees were found at Punwaawaa, in the island of Hawaii, on a bed of lava at a height of about 2,700 feet. The average annual rainfall is 29 in. or less.

*Gossypium drynarioides* reaches a height of from 12 to 25 ft; it produces large brick-red flowers, each of which gives rise to a seed boll containing several seeds covered with short reddish hair. The natives do not use the cotton, but strip the trees of their bark which they use for dyeing fish nets; the colour of the sap is reddish and is waterproof.—BULL. INTERNAT. INST. OF AGRIC.

[Seeds of this tree have been sent to Ceylon by the United States Department of Agriculture.—Ed.]

## FIQUE.

FURCRAEA GIGANTEA.

"There are probably few vegetable products, the subject of domestic industry, particularly in the fibre world, which have so wide an application in everyday use as Fique in Colombia.

"Fique is the fibre of *Furcraea gigantea*, and is grown everywhere in the sub-tropical parts of Colombia, but especially in the districts of limestone formation, where the spiny form is found in a wild condition growing abundantly on the hills.

"In travelling through Colombia one notices everywhere the great variety of application to which this fibre is put. The Alpargatas or shoes worn by the masses in this part of South America are soled with Fique, and it is evident that the consumption of fibre for this purpose alone must be enormous. Sacks or Costales for the collection of coffee on the plantations are made of Fique. Sacks for the local transport of charcoal, maize and

produce generally are of Fique. The pack-saddles and girths for transport mules and bullocks, ropes and cords are likewise of Fique. Matting resembling coconut fibre is also manufactured locally from dyed Fique, and is becoming an increasingly important industry consuming large quantities of the fibre In the towns marketing is generally done with Mochilas or little bags made of coloured Fique; even the banks use little bags of the same fibre for the convenience of their customers for the conveyance of cash, in substitution for paper or linen bags generally used in other countries. Perhaps, however, one of the most novel uses of Fique to be seen in Colombia is the employment of the green leaves for thatching purposes.

"The annual consumption of fibre for the industrial purposes above-mentioned must be very considerable, but, nothwithstanding this, the cultivation and preparation of the fibre is principally a domestic industry. There are a few persons who are now giving attention to the preparation of fibre articles and material by machinery, but up to the present only in a small way.

"In the temperate parts the peasantry generally possess a few plants of Fique, sometimes planted to form a fence to their garden or homestead, in other cases a patch of land useless for other purposes. The fibre they extract by pulling strips of the leaves through a knife arrangement fixed on a tree. One man generally shreds the leaves while another extracts the fibre. By this method two men prepare on the average about ten pounds of dry fibre in a day, which costs in value of labour 7 centavos or $3\frac{1}{2}d.$ per lb. The fibre is sold in the Bogota market for 10 to 12 centavos (5*d.* to 6*d.*) per lb., a much higher price than the fibre realises in the markets of the United States or Europe. In one municipality of some 7,250 inhabitants, the approximate amount of fibre prepared annually by this laborious and unremunerative method is said to be about 100,000 lb. This means to say, on the basis of 5 lb. of dry fibre being the output of one man in a day, that this production represents 20,000 days of labour; which, valued at the local rate of 35 centavos per day, is equal to a money value of $7,000 gold.

"These figures if only approximately correct serve to indicate the local possibilities which lie in the organisation and development of this industry on modern lines, by the employment of suitable machinery. There are few countries where Fique grows so well and lives so long as in Colombia; and the better organisation of the industry locally, which would doubtless result in sound and profitable commercial developments, would, at the same time, release a considerable supply of labour that may be much more profitably utilised."

The following additional information has been extracted from an article in Spanish by Mr. Dawe, published in *El Diario Nacional*. Bogota, for the 8th of March, 1916:—

"Using modern machinery, the cost of production of the fibre and freight to Bogota or other centre in Colombia would amount to $65 per ton, yielding a profit of $95 (£19) per ton, if sold at the present local wholesale price of $160 per ton. The profits on export would be considerably lower, but any surplus after meeting the home demand could be exported to New York at a total cost, including production, of about $95 per ton. This would yield a profit of about £5 to £10 per ton, taking the selling price at £25-£30 per ton.—Kew Bulletin.

# DYE STUFFS.

## NATURAL DYES GROWN IN THE PHILIPPINES

In view of the many inquiries as to the possible position of the Philippine Islands as producers of vegetable dye-stuffs, following the shortage in dye supply in this country, the Bureau of Science of the Islands has prepared a review of the subject, which, however, declares that in view of the increased manufacture of synthetic dye-stuffs in the United States, the lack of available raw materials and the large amount of capital required to start the industry, the conditions in the Philippines are believed unfavourable to the development of the natural dye-stuffs industry there. The review, in abstract form, however, does give the following interesting information in regard to the natural dye-stuffs of the Philippines.

Probably more than 100 species of plants containing valuable colour principles are found in the Philippines, and many more undoubtedly could be readily cultivated. In many cases the colours produced are inferior in quality, being either fugitive or not clear. As the plants that yield dyeing materials grow wild and often are widely scattered, the supply is unreliable and insufficient. Little has been done toward developing the manufacture of local colouring materials, and until there is an intensive cultivation of the necessary plants, and the capital necessary for the enterprise can be secured, there is little prospect of commercial success.

### ONLY TWO PLANTS COMMERCIALLY IMPORTANT.

Only two Philippine dye plants are commercially important. These are indigo and sappan or sibucao. Others are used locally, but scarcely enter into domestic commerce, much less into the external commerce of the archipelago.

Indigo (*Indigofera tinctoria* Linn, and *I. suffructicosa* Mill), locally known as tayum, tayom, tagum, panay, tayum-tayum and tagung-tagung, has been in the past extensively cultivated in some parts of the Philippines, and the prepared product entered extensively into the export trade. With the development of the coal-tar dye industry and the manufacture of artificial indigo, however, the cultivation of indigo as a commercial crop in the islands practically ceased. Indigo is still cultivated on a small scale in some parts of the Northern Luzon, but only to supply a limited local demand for blue colouring matter. It is possible that the extraction of natural indigo might be profitable at present, but the rehabilitation of the indigo industry would take time and a considerable investment of capital in extraction vats, with the practical certainty that at the close of the war the industry would suffer from the competition of coal-tar products.

## EXPORTED IN CONSIDERABLE QUANTITIES TO SOUTHERN CHINA.

Sappan or sibucao (*Cæsalpinia sappan* Linn.) is a shrub or small tree, and is widely distributed in the settled areas of the Philippines at low and medium altitudes. It is not systematically cultivated, yet in a few districts such as Guimaras Island and parts of Panay, it is found in great abundance. In general, it appears only as a widely scattered tree. It has valuable properties and yields a red dye. The wood is annually exported in considerable quantities to Southern China.

Exports of sappan wood from the Philippines to China, exclusive of Hong Kong, in 1914, amounted to 1,515,756 pounds, valued at $6,537, and to Hong Kong amounted to 621,597 pounds, valued at $2,857. During 1913 the exports to China, exclusive of Hong Kong, amounted to 1,173,036 pounds valued at $4,417, and to Hong Kong 1,358,258 pounds, valued at $4,707. No sales to other countries are on record.

This wood yields about 2 per cent. of colouring material by extraction with water. For the export trade, the colour should be extracted from the wood and the water evaporated, thus reducing freight charges. A former member of the Bureau of Science has shown that this wood contains brazilin, the colouring matter found in brazil wood. Brazilin is not a fast dye, and an objection to it is that it is very sensitive to acids and alkalies.

## VARIOUS SOURCES FOR BROWN DYES.

Brown dyes are obtained from numerous plants, chiefly from the shrub or small tree known as bancudo, or nino (*Morinda indica* Linn.), certain of the mangrove trees, such as ceriops and *bruguiera*, the bark of *xylocarpus* (tabigue or nigui), and from numerous others less important. Many of these barks are useful in tanning as well as in dyeing.

Bancudo is the well-known al dye of India. It requires the use of a mordant, since it does not dye cotton directly. Cotton mordanted with tannin is coloured dark red by bancudo.

Black dyes are secured from *Heritiera littoralis* Dry, (dungon late), a common coastal tree, and from some species of *Hibiscus*, *Semecarpus*, *Terminalia* and *Diospyros*. The determining character in most cases is the presence of tannin in large quantities.

Yellow dyes of minor importance are secured from the seeds of *Bixa orellana* Linn. (achuete); from the wood of *Nauclea* (bancal); from *Carthamus tinctorius* Linn., which is occasionally cultivated as a dye plant; from the bark of the common mango; and from species of *Vitex* (molave); and from ligtang, a woody vine having yellow wood rich in berberine.

Berberine is found in several plants of the Philippine Islands. Cloth dyed with it does not show as bright a yellow as that dyed with turmeric, but it has the virtue of being much faster to light than the latter.

## CULTIVATION OF TURMERIC MAY BECOME IMPORTANT.

Turmeric (*Curcuma longa* Lam.), locally known as dilao, is an herbaceous plant of the ginger family. The yellow fleshy rootstocks are utilized for dyeing yellow, but the colour soon fades. The plant does not occur in sufficient quantities in the Philippines to yield a useful supply of the rhizomes. However, its cultivation is a simple matter, and it can be propagated very rapidly. It is extensively cultivated in parts of India, but chiefly for its value as a constituent of curry powder. In the Philippines it needs cultivation and exploitation to become of commercial importance.

*Peristrophe tinctoria* Nees, an herbaceous plant widely scattered in the settled areas in the Visayan Islands and sometimes cultivated on a small scale, yields a beautiful red dye, which is locally utilized in the Philippines. The parts used are the tender shoots and young leaves. This material can be crushed in a mortar and the resulting pulp dried and preserved for future use. It is very doubtful that the plant can be obtained in sufficient quantities or that its commercial utilization is possible. It is known as deora, taoda, and calaora in Mindanao and Negros.—Oil, Paint and Drug Reporter.

# THE DYEING VALUES OF SOME INDIGENOUS DYE-STUFFS.

**J. P. SRIVASTAVA, M.SC., TECH. ASSOC. M.S.T., ASSISTANT TECHNOLOGICAL CHEMIST, CAWNPORE.**

Natural dye-stuffs are perhaps not as bad as they have come to be regarded since their displacement by coal-tar colours. India boasted of a comparatively well-developed art of dyeing in the earliest stages of the historic period. The ancient Indian dyer could dye some very good colours with the help of colouring matters derived from the natural and mineral kingdoms. Some of these colours were fast in every sense of the word and answered all the requirements of the people for whom they were intended. This points to the possibility of valuable colouring matters lying unknown or forgotten in the forests and jungles of this country.

A large number of woods containing red and yellow colouring matters are still used even in Europe, but all these are obtained from America. There are undoubtedly similar woods in this country but no systematic investigation seems to have been made so far.

If America can find a market for so many dye-stuff extracts made from woods and other products, surely we with our vast, varied, and plentiful natural resources ought to have little difficulty in finding out and placing on the market similar products.

This question is of special importance at the present moment. The stoppage of the supply of German dye-stuffs has caused grave inconvenience in all colour-using industries. If Indian dye-stuffs had not been entirely discarded, the distress would not have been so acute. At least some part of the world's requirements would have been met by the dye-stuffs indigenous to this country.

Colouring matters are widely disseminated in the vegetable kingdom. Someone has said that anyone who wishes to spin, dye and weave his own raw material at his own fireside need not go far afield for his colouring matters.

Such is indeed the case in a great many places where cottage industries still flourish. In Donegal, famous for its homespun tweeds, the colouring matters used are still mostly derived from lichens and roots. The colouring matters of Donegal possess great fastness and beauty and their methods of application are alike novel and interesting.

I visited Donegal in 1909 and submitted to the Secretary of State for India a report on the subject of the Cottage industries of the congested

districts of Ireland. I have alluded in this report to the processes of dyeing used in Donegal.

The following investigation into the dyeing values of certain natural colouring matters still used by native dyers was undertaken under the orders of the Director of Industries, United Provinces.

The colouring matters were tried on wool and cotton by some of the more important methods of modern dyeing.

The methods employed were as follows :—

**A.—ON WOOL.**

(*a*) Dyed in an infusion of the colouring matter without the addition of any chemical or assistant to the dyebath.

(*b*) Dyed in an infusion of the colouring matter with the addition of 4% acetic acid.

(*c*) Dyed as in (*b*) and after treated in the same bath with 2% Pot. Bichromate.

(*d*) Dyed in an infusion of the colouring matter on wool which had been previously mordanted with Bichrome and Oxalic Acid.

(*e*) Dyed in an infusion of the colouring matter on wool which had been previously mordanted with Aluminium Sulphate and Tartar.

**B.—ON COTTON.**

The Cotton was steeped overnight in a decoction of myrabolans, next morning it was taken out, squeezed and without washing worked in fresh baths containing the following :—

(*a*) Tartar Emetic.

(*b*) Stannous Chloride.

(*c*) Alum.

(*d*) Ferrous Sulphate.

Generally speaking all the dye-stuffs described hereafter gave the most brilliant results on Stannous Chloride: Tartar Emetic and Alum coming after that. Ferrous Sulphate, as might be expected, dyed grey to black shades.

The inquiry has so far been prosecuted in regard to the following colouring matters :—

**(1) HARSINGHAR (Nyctanthes Arbor-tristis).**

The flowers of this tree contain a beautiful yellow colouring matter. The tree is found in abundance in the United Provinces, and when in bloom yields large numbers of flowers which generally open at night and fall to the ground in the morning. The flowers are collected, dried, and afterwards sold to dyers.

The colouring matter contained in the flowers is soluble in water, and also in alcohol. An extract can therefore be easily made.

Harsinghar gives brilliant yellow shades with all mordants on wool. On wool mordanted with Bichrome and Oxalic acid previous to dyeing a beautiful brown is obtained. The dyeings on wool possess good fastness to milling with soap and soda.

**(2) TUN (Cedrela Toona).**

This tree is said to occur largely in the sub-Himalayan forests. The colouring matter is contained in the flowers which are dried and sold. The principle constituent of the flowers is a yellow dye.

Tun dyes the best shade on wool in conjunction with mordant A(*d*). The dyeings on wool, are, however, not very fast to milling with soap and soda.

**(3) TESU OR DHAK (Butea frondosa).**

This tree is found in abundance all over the United Provinces. The dye extracted from the flowers is still largely used by villagers for sprinkling on their persons as a mark of festivity at Holi festival, about which time the tree is in full bloom. The dried flowers are, however, available throughout the year. The flowers contain a yellow colouring matter.

Tesu dyes on wool shades varying from brown to dull crimson according to the mordant used.

The dyeings are fairly fast to milling.

**(4) ARUSA (Adhatoda Vasica).**

The leaves of this plant yield a yellow colour. Arusa is an evergreen plant and is found in the United Provinces. The colouring matter in Arusa is soluble in water and also in alcohol. The leaves contain a large amount of chlorophyl which is extracted along with the yellow colouring matter. The chlorophyl considerably dulls the dyeings obtained with Arusa. The yellow dye was separated by adding water to an alcoholic extract of the leaves. The chlorophyl was thereby thrown out of solution and the yellow colouring principle was obtained in the filtrate. This gave much better results in dyeing. On wool the best shade is obtained on chrome mordant A(*d*). The fastness of the dyeings on wool is fair.

**(5) NASPAL OR POMEGRANATE RIND (Punica Granatum).**

This plant is well known for its fruit. The rind of the fruit contains a tanning substance and also a yellow colouring matter, the latter in much smaller quantity than the former.

Pomegranate rind dyes very good shades varying from yellow to full brown on wool. All these possess very good fastness to milling.

**(6) JANGLI NIL OR WILD INDIGO—(Tephrosia purpurea).**

This is a small woody annual occurring in abundance in the United Provinces. It does not contain any substance yielding Indigo and its name "Jangli Nil" is probably due to its similarity to the Indigo plant.

Clarke and Banerjee have examined the constituents of the leaves of this plant. They found in it a colouring principle allied to quercetin or quercitrin (*vide* Trans. Chem. Soc., 1910, Vol. 97). Owing to the difficulty of separating the yellow principle from the chlorophyl efforts to obtain a pure yellow from *Tephrosia* have only been partly successful. The colouring matter is, however, of great value, as it yields dyeings which are comparatively fast to light, washing and milling. The yellow principle was separated by extracting the dry leaves with alcohol, diluting the extract with water and washing away the chlorophyl with petrol. The purified colouring matter gave excellent shades of yellow in conjunction with various mordants. On account of the abundance of the plant it may be worth while devising a suitable process for extracting the yellow colouring principle. It would, no doubt, be very welcome wherever Fustic and quercitron bark are still in use. A decoction of the leaves of *Tephrosia* dyes wool mostly dull brown shades in conjunction with the various mordants, the most brilliant shade being that on Tin Mordant. The dyeings, however, possess very good fastness to milling.

### (7) MAJITH (Rubia cordifolia).

The root and twigs of this plant contain a dye-stuff identical with madder. Majith was largely used in this country before the advent of synthetic alizarine. Its cultivation has now, it seems, entirely gone out. It is at present greatly in demand all over India, but enquiries made so far have shown that it cannot be had in quantities large enough to meet the demand for it. It is undoubtedly one of the most valuable indigenous dye-stuffs. With its help red, maroon, and bordeaux shades of excellent fastness to light can be dyed on all fibres. It is the basis of a great many colours required by the calico-printers. The Farrukhabad calico-printers were at one time large users of this dye-stuff and would be glad to go back to it if supplies were forthcoming. Majith as might be expected dyes very fast shades on both wool and cotton. The best results on cotton are obtained by using the Turkey Red process.

### (8) CUTCH OR KATHA (Acacia Catechu).

The Catechu tree is found in several parts of India. An extract made by boiling the wood in water is still largely used in dyeing. Catechu is exported to Europe for use in dyeing and tanning. Catechu may be applied to all fibres, though it is most largely used for dyeing cotton. The usual method of dyeing cotton consists in boiling the goods with an extract of catechu with the addition of copper sulphate, the weight of the copper salt being 10 per cent. of the weight of the colouring matter. The goods are squeezed, allowed to stand for a short time, and then boiled in a fresh hot bath containing 2 per cent. bichromate of potash, washed and dried. Catechu brown is one of the fastest colours known.

### (9) PATANG OR SAPPAN WOOD (Caesalpinfa Sappan).

This tree is said to grow abundantly in Cuttack and in Central India. It is a variety of the so-called Brazil wood which was once upon a time very largely used in dyeing in Europe. The colouring principle, *brazilin*, exists in a colourless condition in the freshly cut wood and is by oxidation converted into the true colouring matter *brazilein*. The wood is similar in its composition to logwood. The oxidation of the colouring matter is carried out by a process of "ageing" in exactly the same way as logwood.

Patang is a valuable colour-yielding material. It can be used for producing brilliant shades of red, crimson and purple and is very suitable for calico-printing.

### (10) LAC DYE.

This substance is of animal origin. It is the product of a small insect called *Coccus lacca* which lives on the twigs of certain trees such as *pipal* and *ber*. The incrustation produced by these insects on the twigs of the trees consists of (1) resinous matter, (2) colouring matter. The colouring matter is dissolved out by means of water or a weak alkali, the resin being left behind. The latter on melting and straining through canvas cloth constitutes *shellac*. The colouring matter is precipitated from its solution by means of alum and is afterwards pressed into cakes and sent out either for export or for sale locally.

Lac dye is manufactured largely in these Provinces, though like other natural products it has lost much of its former importance. Lac dye is dyed

on wool chiefly on Tin mordant. It yields beautiful scarlet and crimson shades.

## CONCLUSIONS.

In the scope of this report it has been only possible to briefly allude to the dyeing values and properties of the various colouring matters examined. Exhaustive trials have already been made with all the above dye-stuffs in conjunction with various mordants on both wool and cotton. The dyeings obtained in each case have been tested for fastness to light, washing and milling. All these samples are being shown at the Exhibition of German and Austrian goods now open at the Upper India Chamber of Commerce, Cawnpore.

These samples have already attracted the attention of users of dye-stuffs who have visited the Exhibition and enquiries respecting them have been received from one or two places.

Surprising as it may appear at first sight, India's natural resources are capable of supplying dye-stuffs required for producing any colour.

The thirteen dye-stuffs described in the above note will enable a clever dyer to produce almost any colour.

We have in the list dye-stuffs yielding yellows, olives, browns, khakis, greys, blacks, reds, scarlets, pinks and blues. Suitable combinations of these colours will give us almost any shade.

The fastness of many of these dye-stuffs is not so bad as one is often led to believe.

It must, however, be admitted that most of these dye-stuffs are not available to-day in large quantities and the prices are consequently prohibitive.

Cutch, lac dye and indigo are commercial products and may be had in fairly large quantities. Tun, Tesu, Arusa, Tephrosia occur wild and arrangements may easily be made for collecting them. Harsinghar and Naspal are not exactly wild products and so their collection will necessitate special arrangements being made.

Majith and Sappan wood are perhaps the most difficult to get at, and, so far as we have been able to gather, their cultivation has practically gone out, but an enquiry into the matter is still proceeding.

A systematic study of the properties and methods of application of these dye-stuffs would, no doubt, bring to light many valuable facts which would make the dye-stuffs more popular with the dyer.

There is every likelihood of a great many more colouring matters being found in the forests of India, but this would be a matter for the Forest Department to deal with.

The examination of indigenous dye materials has been continued in the Technical Laboratory at Cawnpore. A communication on this subject has already been made to Government. Since then some additional dye materials have been examined and the following is a brief account of their properties and methods of application in dyeing.

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[Note.—In the above list accounts of dye-stuffs from Turmeric, Safflower and Indigo, which are not forest plants, have been omitted.—Hon. Ed.]

(1) *Bauhinia racemosa* (Kachnár).—This is a shrub very common in these Provinces. The bark yields a red dye which is largely associated with tannin. The dye is not very bright, but, nevertheless, it may be employed for dyeing dull reds on cotton. It may be dyed on cotton without the help of any mordant. Cotton seems to have an affinity for it. Faster results are obtained on alumina or tin mordant. Kachnar bark is said to be used in Burma for obtaining a dull black colour on cotton. For this purpose the cotton is dyed direct in an infusion of the bark and is then worked in mud whereby the dull red colour is changed into a black (*vide* note by Conservator of Forests, Eastern Circle, Burma, 1896). The bark can be had in any quantity and may be of service to tent manufacturers who require a dull red colour for the inside of tents.

(2) *Ficus religiosa* (Peepul).—The roots of this well-known plant were examined and found to contain a red dye which gives a good pink on cotton mordanted with alumina. The shade so obtained is fairly fast.

(3) *Pterocarpus santalinus* (Red Sanders wood) is a small tree occurring in Southern India. The wood yields a valuable red dye. It was largely used in dyeing before the advent of synthetic colours. The dye principle is called santalin. It was prepared in the laboratory in an impure state from an ethereal infusion of the wood. The crystals deposited from the ethereal solution were further purified by washing them well with water, re-dissolving in alcohol, and precipitating with lead acetate. The precipitate was well washed with boiling alcohol and decomposed with sulphuric acid in the presence of alcohol, on removing the lead sulphate and concentrating the solution pure crystals of santalin were obtained. They melted at 103—105° C. (un-corr.).

Sanders wood dyes wool without any mordant. Very good shades of satisfactory fastness are obtained on cotton, on tin and alumina mordants. The dye does not dissolve in water though it is freely soluble in alcohol, ether and acetic acid.

(4) *Mallolus philippinensis* (Roli or Kamela Powder).—This dye is obtained from a small tree found along the foot of the Himalayas and in Southern India. The fruits have red glands on the surface of the capsule and the powder is obtained by crushing or breaking up these glands. Kamela used to be largely employed for dyeing silk. It gives a beautiful yellow on silk mordanted with alumina. The shade obtained compares favourably with that dyed with Chrysophenine. The dyeing must be done in an alkaline bath.

(5) *Juglans regia* (Akhrot).—The bark yields a valuable brown dye. It is of special importance for wool at the present moment because it yields on this fibre a fast shade which may easily be modified to a khaki. A great many dye trials were made and as a result of these the following conclusions were arrived at :—

(*a*) The deepest shade is obtained by dyeing with an addition of 3 per cent. acetic acid to the dyebath. The fastness to light is, however, poor in this case.

(*b*) Fairly full shades were obtained on chrome—oxalic acid mordant or by the after-chroming process. Both these give dyeings of excellent fastness to light and milling. The poorest results both as regards depth of shade and fastness to light and milling were obtained when the dyeing was carried out with an addition of 15 per cent. Glauber's salt to the dyebath.

(6) *Artocarpus integrifolia* (Kathal).—The wood yields a yellow dye which may be dyed on cotton on alumina mordant. The shades obtained are good and fast.

(7) *Rasaunt* (Barberry).—The bark, roots and stem of this plant are rich in a very good yellow dye. This plant is plentiful in the Kumaun hills. The aqueous infusion of the bark and stem is used as a medicine for ophthalmia and is highly prized as such. The dye principle of Barberry is Berberine which is an alkaloid containing nitrogen. Berberine was prepared in a state of purity from Barberry by adding alcohol to the aqueous extract, whereby all foreign matter was precipitated. On concentrating the filtrate crystal of Berberine were obtained which were purified by re-crystallisation from water.

Rasaunt is used chiefly as a dye for silk. It was dyed on cotton mordanted with alumina but dull shades were obtained. This was perhaps due to the presence of chlorophyl in the preparation which came from Naini Tal.

(8) *Rhus Cotinus.*—The wood of this plant yields a dye similar to young Fustic. On cotton mordanted with alumina an orange yellow colour was obtained; with tin an orange red was obtained. The dyeings are, however, not fast to alkalies and soap.—THE INDIAN FORESTER.

## INDIAN BEESWAX.

The Collector of Customs, Bombay, has informed the Committee of the Indian Merchants' Bureau of a communication from the India Office on the subject of the adulteration of Indian beeswax exported to Russia. It was stated that about six months ago the Russian Church authorities gave their English agents permission to supply East India wax for the manufacture of church candles, but that as the samples of Indian wax proved unsatisfactory, being adulterated with paraffin wax, the Russian authorities were thinking of discontinuing the use of the Indian material. It was pointed out that all wax purchased for the Russian Church should be free from adulteration, and that if a continuous supply of pure beeswax could be obtained from India, it was probable that the greater part of the Russian beeswax-trade would remain permanently in British hands, resulting thereby in a steadily increasing industry for India. The Committee replied that so far as their information went the wax received in Bombay for export purposes was generally adulterated, sometimes equal to 50 per cent., the cause of adulteration being that the commodity had to pass through several hands after it was taken from the forests. The only remedy appears to be to lease a portion of forests to people interested in this trade, so that the purity of the product can be assured.—CHEMIST AND DRUGGIST.

# SOILS AND MANURES.

## THE MICRO-FLORA AND FAUNA OF THE SOIL.

Evidence is gradually accumulating that one great factor of soil fertility lies in the relation which obtains between the numbers of bacteria and of protozoa which live and move and have their being in the soil. Broadly speaking, the bacteria of the soil may be regarded as the gardeners' best friends, and the protozoa—the antagonists and destroyers of the bacteria—as his enemies. If for one reason or another the protozoa increase beyond certain limits, the bacteria fall off in numbers, and the soil, the fertility of which depends in a measure on bacterial activity, is no longer in a condition to supply plant food—it falls sick. Hitherto, the evidence in support of this interesting and important hypothesis has been presumptive rather than conclusive. It was largely of the nature of an inference drawn from the effects of partial sterilisation of the soil. As is now well known, sick soil may be restored to health—that is, may be rendered fertile once again—by exposure to a temperature of about 120°F. At that temperature the active, "thin-skinned" soil protozoa are destroyed, but the "thick-skinned," more resistant of the soil bacteria are not. Thus, when the soil cools down again, the bacteria find no opposition to their increase. They multiply rapidly, and in the course of their growth and activity set free large quantities of material— and particularly nitrogenous material—of a kind suitable for the nutrition of plants.

As is natural and proper, this hypothesis of the case of the enhanced fertilising value of partially sterilised soil has met with considerable criticism. The critics have asked for evidence of the existence of soil protozoa in numbers adequate for the bacteria-destroying part which the hypothesis ascribes to them. Efforts to supply this evidence failed for a long time to meet with much success. It was apparently easier to invent the protozoa than to find them. Nevertheless, as time went on, investigators became more and more expert in enticing the microscopic denizens of the soil to reveal themselves, until now it is no longer to be doubted that a rich fauna of microscopic organisms—protozoa of many kinds—exists in the soil. Nor is there any reason to doubt that these organisms feed on the bacteria of the soil. By analogy with the behaviour of the white blood cells of the body which, as METCHNIKOFF has shown, prey upon intrusive bacteria, the protozoa may be described as the phagocytes of the soil.

Indirect evidence of this phagocytic action has been already provided by RUSSELL and HUTCHINSON, who showed that if a little unheated soil be added to partially sterilised soil, the bacteria do not go on increasing indefinitely. They multiply up to a certain point, but then show a reduction in numbers; the inference being that the phagocytic protozoon police drafted into the partially sterilised soil have, after a certain time, grown strong and numerous enough to cope with the bacteria. Direct evidence—not conclusive, perhaps,

but nevertheless strong—of the truth of this interpretation of the facts has now been provided by Dr. T. Goodey.* This investigator has proved, first that certain protozoa—notably a small amœba (*Amœba limax*), is able to flourish in the soil so abundantly that so many as 30,000 individuals may occur in 1 gramme of soil: that is to say, a gardener, when he turns a spadeful of earth, may be shifting something like 100 millions of this particular kind of protozoon.

Second, Dr. Goodey has succeeded in proving, by actually counting the bacteria and the protozoa present in a sample of soil at different times, that an increase in the numbers of protozoa in the soil coincides with a decrease in the numbers of soil bacteria. For example, when a small quantity of unsterilised soil is added to a bulk of partially sterilized soil the bacteria at first go on increasing until after twenty-one days they reach the respectable number of 160 millions per gramme of soil (about 10 millions per grain). During this time the protozoa, though, no doubt, enjoying themselves at the expense of the bacteria, can, no matter how voraciously they feed, make no impression on such hordes. But their time is coming; they too are increasing in numbers. Thus, at the start, *Amœba limax* occurred only at the miserably low rate of 600 per gramme; but after 43 days, *A. limax* having increased and multiplied so that it now numbers 30,000 per grain of soil, has the bacterial situation so well in hand that it and its assistant phagocytes is able to reduce the bacteria from 160 millions to less than 100 millions per gramme of soil. It must be conceded that these results give substantial support to the brilliant hypothesis enunciated by Russell and Hutchinson, but nevertheless more work on these lines must be carried out before that hypothesis may be regarded as established.

Whether or no the hypothesis be finally vindicated, this, at least, is true —that no garden can afford to be without an installation for soil sterilisation.

—Gardeners' Chronicle.

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## GREEN-MANURING IN INDIA.

**A. C. DOBBS.**

The use of vegetation of all kinds for manure (usually leaves and twigs, collected and transported to the fields) when it could not be turned to any better account, has been perfectly familiar to Indian cultivators from time immemorial. Green-manuring (the turning in and burial of the green crop in the soil upon which it has grown), however, though not unknown in the country, has not been nearly so widely distributed as it should have been.

The attention of the Agricultural Department has long been turned to this important question, and as early as 1882, experiments were made by them in green-manuring at Cawnpore, followed by others at Nagpur and Dumraon, while dating from 1905, field experiments were carried out in almost every Province of India. Important laboratory experiments were made in Madras, Assam, and at Pusa. The above-mentioned Bulletin is a compilation of all the reports relating to this work, and of articles appearing in other

* "Further Observations on Protozoa in Relation to Soil Bacteria," Proc. Roy. Soc. B. 89, No. B. 616, August 1, 1916.

publications, and serves as a general report of the results hitherto obtained. It also gives a short sketch of the work which is being done in this direction at Pusa, and at some of the most important experiment stations of some provincial centres.

The question of green-manuring in India presents special difficulties owing partly to the climate, and partly to the economic condition obtaining there. The drought that prevails for half the year over the greater part of India is succeeded by the hot damp period of the monsoon. The length of the dry season prevents the formation of permanent pastures of Leguminosæ and necessitates continual cultural operations, which as is well known, exhaust the organic matter of the soil. During the monsoon, a tropical luxuriance of vegetation is promoted which might be expected to redress the balance. That it does not do so, appears to be due principally to three causes:

(1) The use for fuel (which is very scarce) of all spare organic matter, including cattle dung, and as much as is not required of the stems of such crops as occupy the ground for the whole of the monsoon season.

(2) Insufficiency of rainfall in many districts, which precludes the profitable cultivation of both a full monsoon crop and a cold weather crop of the same land.

(3) The growth for food purposes of crops like rice which yield a relatively small proportion of straw to grain, and while occupying the ground for only part of the monsoon, yet leave insufficient time, during the remainder, for a second crop to mature; with the result that the ground is frequently left fallow or uncultivated.

In order for green-manuring to be advantageous, the crops used must not take the place of other crops of primary importance (forage, fuel) or interfere with the cultivation of main crops. The advantages of green-manuring depend, as a rule, upon the utilization of a shorter or longer period of the monsoon during which the ground might otherwise be uncovered. Thus the various systems of green-manuring are conveniently classified according to the length of this period, that is, according to the time of sowing or planting the main crop for which the manuring is regarded as a preparation.

(1) Main crop *rice*, transplanted usually six weeks after the first monsoon showers.

(2) Crops (like *tobacco* in Bihar) which are planted at the end of the monsoon, and the cultivation necessary for which precludes the maturing of a monsoon crop; and valuable cold weather crops which require the conservation of a considerable part of the monsoon rainfall for the production of a full yield.

(3) *Sugar-cane*, *jute* and *garden crops* which are sown at the beginning of the hot season on un-irrigated land.

(4) Other *crops grown on irrigated land* and which are thus to some extent independent of the monsoon.

*Rice.*—The most important recent development of green-manuring in India has been in connection with the rice crop.

Experience has shown that the most economical way of growing rice and the method almost universally adopted in India, is to sow the seed in a seed bed and to transplant the seedlings in puddled land, when sufficient water has been accumulated. The interval between the first monsoon

showers and the transplanting of the seedlings can be profitably utilised for the growth of a green manure crop. Under favourable conditions, the seed of the latter can be sown, even at the end of the preceding cold weather, and the young crop will survive the hot weather and be ready to take full advantage of the early part of the monsoon.

Plants which have been successfully used for green manure in the different provinces are: *Crotalaria juncea*, *Phaseolus mungo*, *Dolichos biflorus*, *Sesbania biflorus*, *Sesbania aculeata*, *Tephrosia purpurea*, *Melilotus alba*, *Lathyrus sativus*.

*Tobaccos and valuable cold weather crops for un-irrigated Land.*—Green-manuring for these crops differs from that in practice in connection with rice, from the fact that the manure cannot be puddled in, and, therefore, requires a long time to rot; on the other hand, there is a longer time available before the land is required. The green manure crop can be sown on the early rains in May and ploughed in as near July 15 as possible; the tobacco being transplanted 8 weeks later. The following plants have been used with good success for green manure: *Crotalaria juncea*, *Vigna catjang*, *Sesbania aculeata*, etc.

*Jute, Sugar-Cane and Garden Crops.*—The growth of a crop for green manure is out of the question on typical jute land, but in parts of the Rangpur Pambna and Mymensingh districts, *Crotalaria juncea* is sown in October and ploughed in as green manure for the jute crop, though in many cases the stems and tops are removed for various purposes, and only the roots are left in the ground. As green manure for the sugar-cane are chiefly used: *Tephrosia purpurea*, *Crotalaria juncea*, *Guizotia abyssinica;* for betel, *Sesbania aculeata;* for ginger, the leaves of nux-vomica (*Strychnos Nuxvomica*) and those of *Phyllanthus emblica;* for onions, garlic, etc., *Crotalaria juncea*. In the Punjab, *Cyamopsis psoraloides* is used in addition to the latter plant.

*Irrigated crops.*—The green-manuring crop (especially *Sesbania aculeata*) is grown during the warm season, while the principal crop is cultivated in the autumn-winter season.—BULL. INTERNAT. INST. OF AGRIC.

## ROSHA GRASS.

In a "Note on the Economic Uses of Rosha Grass, *Cymbopogon martini*, Stapf," published in the INDIAN FOREST RECORDS, MR. R. S. PEARSON points out that this grass exists in two forms, known to the natives as "Motia" and "Sofia." The two forms appear to differ morphologically only in the fact that in the Motia grass the leaf blade makes a wider angle with the culm than is the case in the Sofia grass. The distribution of the two forms also differs considerably. Motia growing in isolated clumps on bare hot slopes, whilst Sofia occurs on low ridges and in shady nullahs often as a dense crop. The chief difference between the two forms lies, however, in the characters of the essential oils they contain, Motia grass yielding "Palmarosa oil," containing as much as 90 per cent. of free and combined geraniol, whilst the Sofia form yields the so-called "ginger grass oil," containing only about half as much geraniol. The note states that experimental cultivation of the two forms has now been undertaken at Dehra Dun by MR. R. S. HOLE with the view of determining their botanical relationship.—NATURE.

# ENTOMOLOGY.

## INSECT PESTS IN JAVA.

W. ROEPKE.

The caterpillars of the recently described *Mudaria variabilis*, Rpk., (See this *Review*, Ser. A. iv, p. 88) are in certain years only too well known to the planters on the ripening fruits of kapok, the fibre of which is partly destroyed or rendered valueless. In 1914, 30 per cent. of the pods were attacked, and there appears to be some relation between large outbreaks and exceptional drought during the East Monsoon from May to October. Nothing is known of the earlier stages of this pest. The development of the caterpillars is completed in the still green, but ripening kapok pods, and the undeveloped silk hairs and the unripe seeds are consumed. Even when the pods are apparently not greatly damaged, their remaining content is of very poor quality and stained brown by excrement; woodpeckers that are in search of caterpillars often complete the destruction of the pod. The author has also found the caterpillars on two wild species, viz:—*Bombax malabaricum* and *B. valetonii*. Before pupation a circular hole about one-sixth of an inch in diameter is bored through the shell of the pod. The caterpillars rapidly burrowed in damp earth provided for the purpose in order to pupate between the end of October and the middle of November. At the end of the following May, when the kapok was in flower, emergence was expected, but the first imago did not appear until the middle of August and the bulk of the remainder during September. From nine pupæ which were thought to be dead, but were really in a condition to hibernate again, the moths emerged in the course of the following January, probably prematurely, owing to their having been kept too dry. The fully-grown caterpillar, pupa and imago are described and compared with the closely allied *M. cornifrons*, Moore.

Control seems difficult; the destruction of the wild species of *Bombax* is not considered practicable, and as the attacked pods are not readily distinguished from sound ones, nothing can be gained by early collection of them. No natural enemies other than the woodpeckers, which do more harm than good, have been observed.

The next species dealt with, *Arbela tetraonis*, Moore, is markedly polyphagous with a predilection for kapok. The following leguminous shade trees are also largely attacked:—*Albizzia moluccana*, *A. stipulata*, *Deguelia microphylla*, *Cæsalpinia dasyrachis*, *Pithecolobium* and others. The caterpillar lives in a rather short burrow inside the stem or twig; this serves more as a resting place than anything else, as the living bark supplies the food. Pupation takes place in the burrow and close behind the outlet. The caterpillars are difficult to rear, the best plan being to enclose an attacked stem in a gauze cage, and it was in this way that the author obtained imagines of this moth. The damage done to kapok and other trees is not very serious and cacao is only occasionally attacked and then chiefly neglected or badly

cultivated tree. The caterpillars have been found in Java on *Albizzia moluccana* at a height of 5,000 feet above the sea.

The third pest is a small Noctuid, *Autoba lilacina*, Warren, the caterpillars of which live on cacao and *Cynometra cauliflora*, eating shallow burrows in the rind of the fruit and never penetrating to the interior; fruits badly attacked by *Pseudococcus crotonis* seem to be preferred. Pupation takes place in a retort-shaped cocoon which is attached to the fruits or to a twig near by. The moth is described and its relationships and synonymy discussed at length; the opinion is expressed that this species may prove to be identical with *Eublemma versicolora*, Walk.—Review of Applied Entomology.

## INSECT PESTS OF TEA IN NORTH-EAST INDIA.

E. A. ANDREWS.

The season of 1915 was characterised by an increase in the numbers of certain minor pests of tea and by the occurrence of a swarm of locusts in the Darjeeling, Terai and Duars districts. (See this *Review*, Ser. A, iv., p. 64) *Helopeltis theivora*, Waterh. (tea mosquito) was very abundant in the northern part of the Terai, below Kurseong, but less numerous than usual around Siliguri. In the western Duars this species caused somewhat serious injury during September, and in the Chulso district in the following month. Injury was recorded at Dum Duma between February and the end of the season and was most serious in October. In various localities in Cachar the insect was present in injurious numbers in October and November, while the Balisera and Luskerpur districts were free from attack throughout the season. *Tetranychus bioculatus*, W. M. (red spider) was present in the northern part of the Darjeeling-Terai district during May, and in Cachar and Sylhet gardens affected by floods or difficult to drain suffered from attack. No serious damage was reported from Duars and Assam. Injury by *Termes* sp. occurred in Tezpur, South Sylhet and North Lakhimpur. *Heterusia magnifica*, Butl. (red slug) was more prevalent than usual in one district in Assam during April, July and September-October. Little damage occurred in the Duars and Darjeeling-Terai. *Biston suppressaria*, Guen., was present in districts on the right bank of the Brahmaputra; the autumn brood was the most injurious. *Thosea* spp. (nettle grubs) were reported from the Duars. *Clania* spp. (faggot and bag worms) occurred in small numbers in the Duars, Cachar and Mangaldai. A slight attack of *Empoasca flavescens*, F., was recorded from Bishnath during May.—Rev. of Applied Entomology.

## LOCUSTS IN EGYPT.

L. H. GOUGH AND A. T. McKILLOP.

In 1915 swarms of locusts (*Schistocerca peregrina*) came both from the east and west, as they also did in 1914. Their arrival in the Nile Valley is

dependent on weather conditions. Under Egyptian conditions the best method of destruction of hoppers is by driving them into small trenches and burying. Contact insecticides are useful, but not to the same extent. The adult locusts should be collected and destroyed; the natives do this willingly for a small payment. Internal poisons and *Coccobacillus acridiorum* have proved unsuitable in Egypt. No swarms arrived at maturity and only very little damage was done in general. Cases of appreciable injury were usually due to indifference or negligence on the part of the cultivator or official concerned. Government supervision is absolutely necessary if a locust invasion is to be coped with successfully. The total cost of the locust campaign was £ (E) 16,927; it saved the cotton crop of the Delta, which was in great danger. Seven appendices are given with this report, one of which deals with the appearance of locusts in the second half of 1915, after the campaign had closed in mid-June. Fortunately no damage was done.—Rev. of Applied Entomology.

## NOTES ON INSECT PESTS OF GREEN MANURE AND SHADE TREES.

**E. A. ANDREWS.**

The Noctuid, *Prodenia litura*, F., attacks tea, tobacco, low-growing leguminous plants, *Phaseolus mungo* and *Sesbania aculeata*. The eggs are laid in masses of from 250 to 300 on the leaves and are protected by hairs derived from the body of the female moth. Hatching takes place in from four to eight days and the larva reaches maturity in from three to four weeks. Pupation occurs in the soil at a depth of about two inches; the duration of this stage varies from one to four weeks. Measures for control include the collection of egg-masses and young larvæ. The Pyralid, *Maruca testulalis*, Geyer, feeds in the larval stage on the seeds of pulse; at Borbhetta, Assam, this species was found during September on *Crotalaria juncea* and *Phaseolus mungo* inside the rolled and webbed leaves. Affected pods and leaves should be collected and destroyed. *M. amboinalis*, Field., was found on the flowers and pods of *Tephrosia candida* at Tocklai in November and should be dealt with in the same way. Another Pyralid, *Nacoleia indicata*, F., is found on most pulses and on *P. mungo*. The larva rolls and webs together the leaves of the host plant. The butterfly, *Terias hecabe*, L., has been found on *Acacia decurrens*. Various species of *Bruchus* attack the seeds of leguminous plants, both stored and in the field. At Tocklai these beetles have been recorded in the seeds of *Tephrosia candida* and *Uraria crinita* and on those of a species of *Desmodium* in the Darjeeling district.—Review of Applied Entomology.

## INSECT PESTS OF TEA.

**D. E. DEMOKIDOV.**

The following pests of tea were found during 1910-1914 in the Province of Batum :—*Toxoptera theæicola*, Buckt., *Pulvinaria floccifera*, Westw., *Parlatoria* sp., *Thrips* sp., *Eriophyes theæ*, Watt., *Tetranychus bioculatus*,

Wood-Mason, and *Parametrioles theæ*, Kusn. The last-named appears to be the most dangerous It winters on the tea bushes as a caterpillar, the large ones living in mines at the end of shoots, while the smaller remain inside the leaves. This is in accordance with the normal condition of the life of the larvæ, the first part of which takes place in leaves, and the second one in the shoots. The mines appear at first as minute, brown-grey spots and increase in size with the growth of the caterpillars. The migration of the caterpillars from the leaves to the shoots begins in September or October in the case of the early caterpillars, while the late ones remain inside the leaves over the winter and pass into the shoots in the following spring. In warm winters they remain active and none of them are left in the leaves at the beginning of spring, while in cold winters they may still be found in the leaves in the second half of April. The caterpillars which emerge from the leaves in autumn are 3 or 4 mm. long, and penetrate exclusively into the still soft shoots of the year, showing a marked preference for the most tender part of the shoot toward the apical bud. A shoot thus attacked stops growing and gradually withers. The caterpillars that hibernate in the leaves usually penetrate in the spring into the young buds, just then beginning to grow and giving rise to the shoots for the first tea harvest. The presence of the insects in such shoots shows its effect about the beginning of May, They begin to pupate in the first half of June inside the damaged shoots; pupation takes place during the following two months and lasts about a fortnight, the adults being thus on the wing from the end of June until the end of August. Besides tea, *Camellia japonica* is attacked, and as no injuries to local plants were observed, it is thought that this pest has been imported with these two plants from China. The caterpillars are parasitised by one *Braconid* and two *Chalcidoids* of the genera *Elasmus* and *Plermalus*. The remedies suggested are the burning of the shoots or twigs removed during the usual winter pruning and the cutting and burning of attacked twigs and shoots during the first half of April. Trapping the adults with lights or molasses should also be tried.

In another paper the author gives his opinion that *Parametrioles theæ* has been imported from China, India or Ceylon, though it has not yet been recorded as a pest in these Countries.—Rev. of Applied Entomology.

## HEVEA LEAF DISEASE IN DUTCH GUIANA.

The report of the leaf disease prevailing in the colony made by the Agricultural Department has not yet been published although it is said to be completed. The matter has been treated at length and should furnish interesting reading.

Quickness of action is of great importance in dealing with many fungoid attacks, especially so in the case of the present leaf fungus attacking rubber plantations. What treatment will be recommended here in Dutch Guiana is hard to tell, but as far as can be gathered, a treatment of spraying will be instituted.

On the government rubber plantation "Slooywijk" the disease is rampant, and measures have been taken to cut down the trees and plant in their stead coffee, which, in the government's opinion, will be more remunerative in the near future.

On other plantations in the colony, the disease does not appear to have such disastrous results, and hopes are entertained for an eventual speedy recovery.—India Rubber World.

# SERICULTURE.

## SERICULTURE IN SOUTH INDIA.

T. V. RAMAKRISHNA AIYAR.

(*Continued from p. 249, Vol. XLVII.*)

*Conclusion.*—I have reviewed at some detail the different aspects of Sericulture as it is practised in Southern India at the present day. The above account, however, cannot be considered complete without some general observations on the main aspects of the subject and some suggestions in the way of effecting certain improvements in the local methods. It may be stated without fear of contradiction that every aspect of this industry in its present condition admits of some improvements in all directions. From the growing of mulberry to the preparation of raw silk for the market every process allows room for some change. And it is the silk farmer of Kollegal that might bring about these improvements one by one with the greatest advantage. Firstly, in the matter of mulberry cultivation the Kollegal farmer may run away with the idea that in proportion to his outlay he gets comparatively better profits than his brother in Berigai or Bengal. But it must be stated that this indifference and the policy of little outlay and small profits will not only retard progressive sericulture, but would go a great way to deteriorate the cultivation of this valuable and paying crop—mulberry. With the cheap labour at his command and the ideal physical features, with only some extra care and investment, in the matters especially of soil selection and preparation he can not only increase his profits but bring this important crop to the fore-front from the inferior position it occupies at present. Instead of selecting large areas of indifferent soils and working with them it would be highly advantageous if smaller areas of better soils are taken up. It is always better to manage a small plot efficiently and get better results than looking after big areas indifferently and get small returns. By cultivating the lands deeper and paying more attention every year to the plot than at present, it may be kept on flourishing for several years. I believe that this indifferent cultivation of mulberry in Kollegal is due to the fact that the silk-worm rearer is often a different individual from the mulberry grower, whereas in Berigai it is not so and the difference between the two is quite evident. Coming next to the matter of the cultivation of the worms, we find that no other aspect of silk industry shows more faulty methods and stand in more urgent need of improvements. The main secret of success in sericulture depends upon the proper care and treatment of the worms. Our silk farmer here is sadly unaware of this important maxim and pays the penalty for the same. He is aware that a good percentage of the worms are carried away by diseases and yet he does not take any pains to rectify the evils. The housing, feeding, handling and the general treatment of the worms are all exceedingly crude and slovenly. Good ventilation is an extremely important factor with silk worms and this is neglected in more ways than one. Silk worms are not to be housed in dingy

ill-ventilated, dusty and unclean rooms nor in odd places in dwelling houses where the air is always vitiated by impure air. This want of fresh air naturally affects the vigour of the worms and gradually makes them easily susceptible to different diseases. The very close arrangement of the trays in each vertical row of a meja (12 trays within a height of 6 ft.) leaving very little air space between two trays of worms and the common crowding of worms in individual trays, also add to the want of proper ventilation. The mejas containing trays of worms should always be kept in a well ventilated portion of the house where the surroundings will always be sanitary. It must not be a room where the inmates of the house eat and sleep, nor should any cattle be penned close by. If possible the best thing would be to build a small shed for the silk worms separately in the open space and grow mulberry all round. There must be at least a space of 8 inches or 9 inches of space between adjacent trays in the meja so that fresh air can freely pass through As the worms grow in size they must be given more and more space and must not be crowded in trays. The more the space given to worms, especially during the younger stages, the healthier they grow and bigger the cocoons they spin. The change of bed now practised by slanting one tray over the other and injuring many worms is not only clumsy but extremely prejudicial to the health of the worms especially young worms. The use of nets or perforated paper of different meshes will save a great deal of time, trouble and injury to worms. The disposal of litter is another matter calling for some remark. The impure gas given out by this stuff is very injurious to the worms and yet the rearer keeps it heaped up for hours together close to the rearing meja. It must always be taken far away from the rearing room as soon as possible after change of beds, and then fed to cattle or otherwise disposed. The general handling of the worms, especially while being transferred from tray to tray or to the chendrike, also deserves a note. Silk worms are very delicate insects and they must not be touched with the hand as far as possible ; but when necessary they must be handled very gently. When in the trays or on a chendrike a worm is found dead by accident or injury it must be at once removed with the litter and not allowed to remain where it is and rot. Even on the floor of the rearing room dead worms should never be allowed to remain. The system of disinfecting the appliances at the end of each brood is a thing quite unknown to our silk farmer. It is always better to wash all appliances with a 1% solution of copper sulphate after each brood, as this is a preventive against diseases and the practice of using cow dung to smear the trays, etc., should be discouraged.

All these are small points apparently, but each one of them if not attended to will contribute its share to the development of the various silk worm diseases. The health of his silk worms can be greatly improved if only the silk rearer cares to attend to at least a few of the points noted above. We would thereby be able to get more cocoons and of better quality. It may also be stated that the improvements in this direction cost almost nothing and could be easily effected if one has only the mind. Improvements in the method of reeling silk cocoons and preparing the silk for the market can also be effected with advantage. The use of good water to boil the cocoons, feeding of fewer cocoons in reeling, arranging two or three croisures of the silk threads instead

of one, making knots when the silk threads break in the process of reeling—these are some of the simple and easy improvements that might be effected in connection with the reeling of silk cocoons, But since there is sufficient demand for the rough 'Korra' silk the Kollegal reeler does not appear to be very anxious to introduce any improvements to get better qualities of silk. To those, however, who wish to produce finer silk with a higher market, the value of these suggestions might appeal to a certain extent. In addition to all the above points there is one aspect of the whole question of silk-worm rearing which is of the utmost importance and which above all will contribute to the success of the silk worm industry. This is the selection of healthy seeds for propagation. The want of proper attention to this one point alone has contributed not a little to the decline of the industry not only in Kollegal but in many other silk centres. The rearer should make sure that the seeds he starts with are healthy and free from disease—especially the hereditary "pebrine." For this he must get seeds from reliable sources where disease-free seeds are sold.

Before concluding I must add a few words on the attempts the Madras Government has been making to revive the industry in Kollegal. An officer of the Agricultural Department subordinate to the Government Entomologist and having some training in Sericulture is stationed at Kollegal with the special object of advising the silk-worm cultivators to adopt the improved methods of sericulture. He visits the rearing villages, selects disease-free seeds for the rearers, demonstrates disinfection of their rearing sheds and appliances, shows them the use of nets and perforated papers for changing beds, and advises them in the methods of proper feeding of the worms and good sanitation. He is at present chiefly engaged in demonstrating the improved methods by carrying on silk-worm rearing himself on a small scale and selling disease-free seeds to rearers. For this purpose he has for the present confined his work to one important silk rearing village, so that with the improvements he introduces this might form a sort of centre to attract other villages. That his seeds command a higher market value shows that the improvements are appreciated by the silk rearers. In addition to the attention paid to the immediate wants of the industry a few experiments are tried under the guidance of the Government Entomologist in the way of acclimatising the univoltine European silk-worm and the trial of the leaves of the mulberry trees instead of those of the bush as food for the worms. The European silkworm is being tried with success in some other parts of India at present and it is well known that all races of worms when fed on the tree-mulberry leaves give more silk than when fed on the bush-mulberry. If all the silkworm rearers of Kollegal begin to appreciate and adopt some of the easy improvements suggested above—as some of them are already doing—thanks to Government efforts—they are sure to adopt newer improvements which might improve their lot and thus open a bright and prosperous future for this much neglected but very valuable and ancient industry.

# CO-OPERATION.

## CO-OPERATION IN INDIA.

[We take the following from a review by "Rusticus," in the Mysore Economic Journal, of an article in the Quarterly Review by Mr. R. B. Ewbank, Registrar of Co-operative Credit Societies, Bombay.]

England has set the whole world an example of the way in which co-operation can be used for purposes of production and distribution. The idea of using co-operation to obtain credit has, however, hardly as yet taken root in that country. Mr. Ewbank's description of the constitution of the ordinary primary societies was, therefore, very necessary for readers in England but need not detain us here. Of more interest to co-operators in India is his discussion of the two questions: How far has the co-operative movement succeeded in obtaining funds in the shape of loans and deposits from the public for reasonable terms at moderate rates of interest and how far is the working capital so obtained adequate to meet the needs of members?

In regard to the first of these questions, Mr. Ewbank explains that the working capital of societies is derived partly from members in the form of fixed deposits and shares, partly from non-members as deposits and loans and partly from Central Banks established for the purpose of supplementing the funds obtained locally. As one of the prime objects of societies is to encourage thrift, the extent to which they are able to attract deposits from their own members is obviously a most important test of success or failure whilst the amount of deposits made by non-members is a valuable gauge of the public confidence societies enjoy. Mr. Ewbank points out that, in India, the total proportion of capital obtained locally is only 31 per cent. as against 87 per cent. in the Raiffeisen societies in Germany. Of this 31 per cent., 18 per cent. is made up of deposits of members and non-members which are almost equal in amount whilst 13 per cent. represents the amount subscribed by members as shares. Mr. Ewbank, though fully alive to the difficulties which stand in the way of an increase in this percentage, the conservatism of the ryot, the high rates of interest obtainable in commerce or private money lending, the paucity of persons in possession of capital in India compared with Germany,—is strongly of opinion that the proportion of capital raised locally is less than it should be and that it must be increased before things can be regarded as quite satisfactory. The 69 per cent. of working capital, which is not raised locally, is made up of accumulated reserves, which it is satisfactory to note amount to 7 per cent. of the total as against 4 per cent. only in the Raiffeisen societies in Germany, and of loans from Central Banks. It would have been of interest if Mr. Ewbank had stated how far State aid, which has practically been discontinued in India, is given in Europe.

MR. EWBANK hesitates to give a definite answer to the question how far the working capital of agricultural credit societies is adequate to meet the needs of members. He points out that the actual amount available for loans is about £3,000,000 distributed amongst about 14,000 societies with an average membership of 41 each. The sum available per head, therefore, works out at about £5. The size of holdings varies greatly in different parts of India and so does the cost of cultivation of different crops but, in any case, an average of £5 seems very low when the various objects for which agriculturists require money—current expenses of agriculture, land improvements, domestic expenses and the liquidation of old debts are taken into consideration. MR. EWBANK, therefore, concludes that it is probable that the total working capital is at present barely enough to meet the current agricultural needs of members.

The most difficult problem is presented by old debts. If a society does not pay off the old debts of a member on admission it means that his property is subject to a lien prior to that of the society, that the member has to serve two masters instead of one and that the out-turn of the society's loans may be seized by the money lender in payment of his dues. On the other hand, it is unwise for a society to lock up its money in long term loans and the grant to a member, immediately on admission, of a large advance to pay off his old debts without any corresponding effort on his part is apt to corrupt his zeal and integrity. The true solution of the difficulty has yet to be discovered.

MR. EWBANK next proceeds to describe the higher storeys of the co-operative edifice. The functions for which such higher organizations are required are, of course, to finance primary societies and to train and supervise them. Co-operation in India has not yet reached the stage at which Joint-Stock Banks are willing to deal direct with primary societies. The supply of funds to such societies has, therefore, been secured by the formation of Central Banks, of which there are 189 in British India controlling a working capital of about £1,300,000. Central Banks are organized differently in different provinces and, of the various types of organization, MR. EWBANK considers the most successful that in which both affiliated societies and individual shareholders are included in the membership. This mixed type, which flourishes in the Gangetic Provinces, has two great advantages. As the societies financed by a Central Bank take up shares in it in proportion to their borrowings from it, the Central Bank is compelled to realise that it is the servant and not the master of the societies to which it lends. The individual shareholders, who are usually local men of influence, supply the business ability without which the Bank would fail and their presence on the directorate greatly enhances the credit of the institutions. This type, therefore, is the one most calculated to reconcile the interests of lenders who look mainly for safety and good dividends, with those of borrowers, who demand cheap loans and convenient terms of repayment. The criterion of the success of all Banks, whether of the mixed type or not, is obviously the soundness and efficiency of their finance. No Central Bank has so far failed in such a way as to cause loss to the public, but MR. EWBANK thinks that it is clear that most of them have not succeeded in gathering sufficient capital to meet the needs of their clients and that it would be wise to retard the

formation of fresh primary societies until Central Banks are able more fully to supply the demands of societies already in existence. As regards the raising of funds by Central Banks, MR. EWBANK points out the difficulties which result from the fact that loans invested in agriculture can only be recovered at the harvest season. There is, however, no such restriction of season in the case of deposits and although, in order to meet the possibility of their withdrawal at any time, cash credits to the total amount of £136,000 have been arranged in thirty-six cases with Presidency or Joint-Stock Banks, this has not been found an altogether satisfactory expedient as the support so given is liable to be withdrawn at dangerously short notice. The alternative of maintaining large amounts of cash on hand is still more unsatisfactory. The solution of the difficulty lies, as MR. EWBANK points out, in the extension of the system of Provincial Banks which would serve as balancing centres, as suppliers of working capital and as holders of cash reserves for the support of Central Banks when their own financial resources fail.

The part of MR. EWBANK'S article which is, perhaps, of the greatest interest to co-operators in India is that in which he enumerates the local conditions, which, in his opinion, will, as time goes on, have the result of distinguishing the co-operative organization in India more and more widely from its European model. The first of these distinctive features is the wide margin of interest on which Indian societies are able to work. In Europe, the margin between the lending and borrowing rate seldom exceeds one per cent. In India conditions are quite different. Societies advance loans at rates well in excess of the rates which are payable on deposits and it is, in point of fact, desirable in the interests of their members that they should do so, for too easy credit encourages reckless borrowing. But the result is that their profits are more substantial than those made by European societies and they are able to build up an owned capital in the form of reserve funds at a much more rapid rate. MR. EWBANK'S statement that the accumulated reserves in India amount to more than 7 per cent. against only 4 per cent. shown by the Raiffeisen societies in Germany, although the great majority of the latter have been in existence very much longer than Indian societies, will be remembered in this connection. The accumulation of a substantial reserve enables Indian societies not only to subscribe to shares in Central Banks and so to secure control of them but also to contribute to the expenses of their own audit and supervision.

Another distinctive feature of the Indian co-operative movement is the nature of the control exercised by Government. In Europe, co-operators are left almost entirely to themselves so far as the management of their own affairs is concerned and the State help which is given takes the form of the provision of funds and of facilities, for discounting agricultural bonds and pro-notes through some form of State guaranteed and State controlled Bank. In India, the position is reversed, as a result mainly of the illiteracy of the rural classes. State help does not take the form of financial assistance, but of careful official supervision and detailed audit of every society. This, MR. EWBANK argues, is the sheet anchor of the whole credit movement and, at the present stage of development, is the chief feature which inspires the

public with confidence. The apex banks, the formation of which MR. EWBANK regards as nearer than many people think, may require a Government guarantee to help them in negotiating agricultural paper. But whether State help becomes necessary in this form or not, MR. EWBANK insists that State control through the medium of official Registrars is the very foundation of the success which has so far been gained. "The movement is still in its infancy and any relaxation of control before co-operators have learnt to stand firmly on their own legs, would inevitably be followed by a collapse as startling as the growth has been."

## CO-OPERATION AND AGRICULTURE IN UPPER INDIA.

A. P. SMITH.

The results of organized co-operative credit as regards liberating the Agriculturist and the Industrialist craftsman from pecuniary embarrassment which, like an incubus, weighs down the hopeful endeavour and cripples his activities in every direction are acknowledged. The close association of co-operative effort in improving agriculture is also admitted ; but little or no positive effects have been postulated in moral and social directions. In the report on working of Co-operative Societies in the United Provinces of Agra and Oudh it is most encouraging to read that in a measure the co-operative movement has tended to raise the economic and social status of members of the "depressed classes." "Members of the so-called untouchable classes," says MR. A. C. CHATTERJEE, the Registrar, "have a powerful voice in committee meetings and I have come across instances where they have totally excluded high caste men who considered themselves privileged to mis-spend their borrowings or to disregard dates fixed for repayments," Character in every position of life tells for much, and the man who is scrupulous with regard to paying his debts, even if his caste is low, ranks higher in the estimation of business men than the defaulter. Defaulting often comes of vices like gambling and drinking and association with what KIPLING calls "the painted iniquities," and men decline to associate in business with unstable and loose liars. A business reputation for probity naturally invites confidence, and social relations become established which go far to break down the barriers of caste and class. But it is not only with regard to paying his way that the ryot is benefitting, for co-operation has promoted sanitation, and has brought home to the ryot in an unexpected way his duties and obligations to the poor and needy, the ignorant and the sick and suffering, for we read that small funds are being instituted by several societies to ameliorate the condition of those in need of pecuniary help, and primary schools have been opened, which have done so well that they have received the countenance and financial assistance of the District Boards. Among the ignorant and poverty stricken are sure to be found the sick and suffering and co-operative societies are stocking simple and everyday medicines like quinine, etc., for distribution. But there is nothing really surprising in these natural developments of self-respect and improved pecuniary status. Poverty is the root of

much evil, sin and sorrow, and when a human being is on the ground and can sink no lower, despair seizes hold of his soul and he gets callous and desperate. Raise him, give him the means necessary to feed himself and family with a trifle over to inspire him hope for the future, and his self-respect is awakened, his sympathies are raised and his desire for his own well being and that of his neighbours is stimulated. This is so everywhere, but more especially so in India where village and communal existence in the co-operative caste system, is in the life blood of the people. The caste system is out-worn and is no longer compatible with the individual assertion of the rights of man, but the co-operative principle, in the Western sense of the term, is one which, when it is fully understood and extensively utilized, is associated closely with the practical self-government of the people of this country. When socially the people are able to help themselves political autonomy will follow as a natural consequence. It may safely be said of the co-operative movement that it is by far the most important measure that has been established in India during the last fifty years. So far as the more immediate progress of co-operation in the Province is concerned, owing to the War, seasonal disabilities and the failure of crops resulting therefrom, much expansion was negatived, and efforts were directed to weeding out undesirable members and weak societies and strengthening and consolidating existing societies. Bad harvests and consequent shortage of food staples necessitating the purchase of imported grain, resulted in causing hardship all round and precluded the repayment of loans while something like a financial panic for a short period affected the deposits. The Directors of Co-operative Banks at this crisis obtained a loan of two and half lakhs of rupees repayable in two annual instalments to enable the Banks to grant further loans only, there being no inability to meet the withdrawal of deposits. The recovery from the uneasiness regarding the safety of money was so rapid that the Government loan of two and a half lakhs was repaid in six months.

The financial position of central societies improved during the year, but only three new societies were formed. The unsatisfactory working of central banks is complained of, two of which had to be closed. Two district and one central banks were established. Banking in India has been unfortunate, to say nothing more, and the smash two years ago has shaken public confidence throughout the country. The problem of steadying and systematising banking operations and restoring confidence is being carefully considered everywhere. The overdue debts of the central societies in the Province amounted to nearly twelve lakhs, but no apprehension of safe recovery is felt.

In the case of primary agricultural societies too the arrears amounted to something a little over R. 17 lakhs for the same reasons which retarded repayment among central societies. The agricultural societies in the Province are of much greater importance than the non-agricultural credit societies. Four of these last are for cattle insurance and are only in the experimental stage. The Provincial Government are disposed to back up these societies with funds to give them stability and a fair trial, and are of opinion that as cattle insurance has thrived in Burma there is no reason to despair of cattle insurance doing as well locally, With the object of studying the Burma system, the Registrar will proceed to that country this year. An agricultural supply society, from which much good is anticipated, has also been established. The success of the Telegraph Society is recorded with satisfaction. Indeed the

members of the telegraph department have always exhibited a sense of corporate combination and unity, and the Lieutenant-Governor endorses the opinion of the Registrar that every facility should be extended to departmental clerks to form societies of the same kind. The unlimited liability trading societies did not prosper as trade was slack.

The process of winding up a society is hedged round with some difficulty and prompt and effective measures, on the liquidators' part, are not, in the present state of the law, feasible. Enforcing payment through a law court has not only an injurious influence on society still struggling along but there is always considerable delay and dislocation of work involved. Liquidation should be a swift and relentless process. It is thought the District Collector should be empowered to recover dues on the liquidator's orders in the same manner that land revenue is recovered. This is done in other instances having no direct connection with land and there seems no objection to this course of action in connection with agricultural societies. In the case of the liquidation of non-agricultural societies such a course would hardly be possible. The Lieutenant-Governor only awaits the Government of India's orders on the Report of the Maclagan Committee to take proper steps.

Agriculture in the Province has responded, in its own way, to the influence of the War. A rapid fall in prices of cotton led to the partial abandonment of the extension of particular types, in favour of the substitution of indigo and foodgrain crops. Indeed the indigo crop has shown remarkable powers of reasserting its position as a paying product; but its future is in the necessities of the case doubtful. Naturally a drop in cotton affected the co-operative societies of which the agriculturists were members. Indeed in other respects a growing co-operation is apparent between the co-operative societies and agricultural endeavour. Banks have opened seed stores and the distribution of seed and irrigation on co-operative principles are being tried. In well-boring operations and in providing pumping plant co-operation is calculated to furnish the capital which individuals find it impossible to advance.

One of the satisfactory features of agricultural development is that some of the large landlords have taken to assisting their tenants with good seed and by opening private farms in which improved agricultural operations are demonstrated. This is a most healthy and hopeful sign. In England, it is the landlord who is interested in improving agriculture, for in most cases he is a practical agriculturist himself. In India, zemindars and other landlords content themselves with the receipt of their revenues, caring little for the advancement of agriculture or the welfare of their lands. An increase in such private farms will relieve the department of much spade work. Some thirty-seven private farms in the eastern circle alone gives cause for congratulation.

Experiment in this circle has proved *inter alia* that neem (margosa) oil cake applied to paddy at the rate of 600 lb. per acre increases the acre's yield by 50 per cent, that paddy seedlings planted eight inches apart furnish the best results, that manuring with sunn hemp resulted in 34 maunds of wheat per acre in the Benares Agricultural Station, that maize and potatoes sown in rotation and ground-nut and tobacco in rotation for one year, can give a net profit of Rs. 263 and 132½ per acre respectively. Experiments

with fodder have conclusively made it clear that it can be preserved in silos for nearly a year in good condition, that after exposure to the air for a short time it is relished by cattle and that it is far more nutritious and digestible than any other kind of fodder available during the hot months.

Agricultural Education is naturally a *sine qua non* and the more it is simplified and extended the greater the benefit to the people. In the Agricultural College there are two courses, a vernacular course of two years and a higher diploma course of four years. The first though scientific in theory, is a practical course for men of limited education and the second is for those desirous of obtaining a more extended study. Training is also provided for the *mali* or gardener class in horticulture, a very desirable departure.

Intensive cultivation is slowly but steadily growing popular. Unremitting research and experimental work, combined with demonstration, is slowly but steadily establishing agriculture in the Province on a firm and prosperous basis.—Mysore Economic Journal.

## THYMOL PRODUCTION IN THE WEST INDIES AND FLORIDA.

The Imperial Department of Agriculture for the West Indies is again responsible for starting what may possibly develop into a minor industry in these islands. This statement has reference to the introduction of *Carum copticum* (Ajowan) seed, the plants of which yield the well-known antiseptic thymol. The plant has grown well at several of the Botanic Stations, and if the oil can be satisfactorily distilled (and there is no reason to think that this cannot be done), it is possible that the cultivation of this plant in certain districts might pay.

The object of this note, however, is to call attention to an effort that is being made in Florida to produce thymol commercially from horse-mint (*Monarda punctata*). A Bulletin (No. 372) contributed from the Bureau of Plant Industry, United States Department of Agriculture, states that the annual consumption of thymol in the United States is sufficiently great to warrant a small industry for its production when carried on in connection with the distillation of other volatile oils. This is exactly the position in the West Indies. If the stills used for bay oil, lime juice or rum could be made use of when unemployed for their principal function, Ajowan oil could be profitably produced. Figures are not available as to the return per acre to be expected from Ajowan cultivation in the West Indies, but it is estimated in Florida that after the first the Monarda crop would give a gross return of about $40. The cost of production would of course be cheaper in the West Indies than in the Southern States.—Agricultural News.

# GENERAL.

## THE CEYLON AGRICULTURAL SOCIETY.

### PROGRESS REPORT LXX.

#### MEETINGS.

The last quarterly meeting was held at Jaffna Kachcheri on the 29th February, when MR. B. HORSBURGH, Government Agent, Northern Province, presided and the attendance was large and representative.

The members of the Agricultural Department present included the DIRECTOR, as Organising Vice-President; MR. M. KELWAY BAMBER, Agricultural Chemist; MR. G. M. HENRY, Assistant Government Entomologist, MR. T. H. PARSONS, Curator, Royal Botanic Gardens and MR. B. F. SCHERFFIUS, Tobacco Planter.

The subjects discussed were (1) The Applicability of Dry Farming to Coconut Cultivation in the North, (2) Curing and Fermenting of Tobacco and (3) Cattle Insurance.

The annual meeting of the Society was held on June 6th in the Council Chamber, Colombo, with HIS EXCELLENCY SIR JOHN ANDERSON in the chair, and there were also present 45 others.

The opportunity was taken to present HIS EXCELLENCY with an Address of Welcome on his first appearance at a Meeting of the Board.

Besides the Annual Report of the Secretary the following papers were discussed:—Tropical Agriculture under Irrigation, Future of Rural Agriculture in Ceylon; Agricultural Improvement in Headmen's Divisions, and the Agricultural Possibilities of Delft.

#### MEMBERSHIP.

The following new members were enrolled since the last quarterly meeting:—H. E. JENNINGS, EDWARD F. STONE, S. W. MOORHOUSE, RAO BAHADUR BARODA, C. HERBERT DE MEL, THE BUREAU OF FOREIGN AND DOMESTIC COMMERCE U. S. A. Department of Lands and Agriculture, Apia, H. S. STEVENS, General Rubber Co., Singapore, H. B. LARKIS, P. M. JOHN, THE RUBBER PLANTATION INVESTMENT TRUST LTD., South India, OFFICER IN CHARGE Natal Herbarium, Taivan Factory of Dainippon Sugar Co., Ota.

#### STAFF.

The Organising Vice-President travelled through the Kurunegala, Negombo and Chilaw districts: the Secretary in the course of his inspections visited Kesbewe, Matugama, Kalutara, Matale. Naula, Kalawewe, Dambulla, Vavuniya, Mullaittivu, Talatuoya, Panwila, Hettipola, Wariyapola and Kegalle.

MR. L. A. D. SILVA was occupied at Kegalle and Balangoda. MR. MOLEGODE made a special visit to Wellawaya and Nikaweratiya, MR. KARUNANAYAKE itinerated between Matara and Tissamaharama, MR. NUGAWELA'S duties kept him busy in the Kandy district. MR. MADANAYAKE itinerated in Galle district. MR. JAYASINHE was occupied in the Kurunegala-Puttalam districts. MR. RAMANATHAN and MR. CHINNASWAMIPILLAI attended to work in the Northern and Eastern Provinces respectively.

## SOCIETY'S GARDENS.

The Society's Gardens are doing good work in most instances. Much however depends upon the interest and energy displayed by the Instructors, and the following extract from the last Administration Report of the Government Agent, Sabaragamuwa Province, is encouraging:—

"The appointment of the Agricultural Instructor at Balangoda is producing good results. His duties, besides the experiments at the Balangoda Garden, include excursions into villages to advise and assist cultivators in their field work. Various experiments were carried out with vegetables, grains, and cinnamon, and the results obtained were promising. The garden is a move in the right direction, and good results may be confidently expected."

In addition to the gardens at Balangoda, Bandaragama, Weeragoda, Ambalantota, Mediwaka and Hettipola, it is proposed to establish one at Akmimana near Galle. The suggestion to open a garden came from Mr. E. V. Gooneratne, Atapattu Mudaliyar, Galle, and the matter is now before the Government Agent, Southern Province. There is no doubt that well-conducted gardens contribute more than any other means to the improvement of cultivation, and with School Gardens appealing to the younger generation and the Society's Gardens to the older, valuable results, such as those reported by the Government Agent of Ratnapura may be expected in various parts of the Island—particularly in backward districts.

## EXPERIMENTS.

Mr. T. W. Blyth-Perrett of Vandaramulla Estate, Batticaloa, forwards the following interesting report on experiments conducted by him:—

"My paddy trials did well, on Chandavelly. I obtained two crops of paddy in 10 months and I put down the third crop last month which will be ready in September. The first crop brought in 12 amunums, the second 13 amunums per acre. This without manure, but I manured the land before putting down the third crop so it should do better this time. I have taken on rent two pieces of land, 100 and 35 acres in separate places and these I am putting under paddy in September. I am applying bonemeal and cattle manure to both lots, and to the 35 acres leaves from the jungle in addition. As paddy is usually attacked by various insects, I have a stock of remedies to check it, as I have done at Chandavelly.

"My garden on Vandaramalla Estate is now paying well. After meeting all expenses, cost of seed, etc., I have cleared Rs. 80·62 in April and since then the average nett profit has been Rs. 64 a month. The vegetables are sent to Batticaloa for sale. The area cultivated is about $1\frac{1}{2}$ acres. I am going in for 'intensive gardening.'"

Experiments such as the above by members of the Society are just what are wanted to provide ocular demonstrations to the villager (to him the only convincing proof) of the opportunities within his grasp.

## PADDY.

A number of new paddies were recently introduced from India and are being cultivated at the following centres:—

*Name:* Thonnur; *Age:* 3 months; *Centre:* Wellawaya, Suduganga Estate (Matale), Peradeniya; *Name:* Gnavara; *Age:* $2\frac{1}{2}$ months; *Centre:* Nalanda, Wellawaya, Jaffna; *Name:* Vethumyla; *Age:* 3 months; *Centre:* Nalanda, Wellawaya; *Name:* Moli Karappen; *Age:* 4 months; *Centre:* Medewalla, Jaffna; *Name:* Marawir; *Age:* 4 months; *Centre:* Madugoda, Jaffna; *Name:* Kar; *Age:* 4 months; *Centre:* Peradeniya.

There has been a good demand for Molagusamba Paddy. 35 bushels of seed have been distributed to 21 centres. Arrangements are being made to raise seed during next Maha on a field to be worked by the Society.

The following are particulars of a transplanting experiment carried out by MR. J. R. NUGAWELA, Agricultural Instructor, at Panabokke, near Kadugannawa:—

Extent 1 acre. Variety of paddy: Hatiel, 7 months. Method: Seedlings were raised in a nursery and when about 2 months old were transplanted 6 × 6 at the rate of 3 seedlings per hole. *Yield.* 61 bushels 12 measures. *Extra cost* Rs. 5 for transplanting. *Ordinary yield* per acre in the village, 40–45 bushels.

The fields sown with Sunnhemp at Alawatugoda, Uduwawala and Hiyarapitiya have been sown with Hatiel paddy. The fields on Marakona Estate and at Naulla are still carrying the sunnhemp.

## COCONUTS.

In the Progress Report for February, 1913 (No. LXI) a description (with illustration) was given of a coconut husking machine, which at that time was being manufactured in Berlin.

In reply to enquiries made about a similar machine of British manufacture, the Director of the Imperial Institute writes:—

"It appears that no British firm is at present manufacturing a machine for simply husking coconuts without cutting through the nut also. The machines available cut the entire fruit into three parts, and are of the type of which I send illustration. Such machines are quoted at from £85 to £105 f.o.b. at a British port. I presume, however, that a machine of this type would not be suitable for your purpose.

"I am informed by MESSRS. ROSE, DOWNS and THOMPSON, LTD., Dunster House, 12, Mark Lane, London, E. C., that some months ago they were considering the manufacture of a machine for simply husking the nuts, but they have had to postpone the matter owing to the pressure of munitions work. It is possible that after the war either this firm or some other British firm may be disposed to take the matter up."

To a member writing from Fiji enquiring whether Couch grass planted among coconuts, to keep down weeds and furnish food for pigs, is to be recommended, the Government Agricultural Chemist replied:—"Couch grass would probably be one of the worst things to sow among coconuts. It is always eradicated in Ceylon. I would suggest planting sweet potatoes (Ipomea) which grow luxuriantly, smother all weeds, and make a very useful food for pigs."

A further consignment of 200 San Ramon seed coconuts from the Philippines is expected shortly to meet applications from members.

## COTTON.

In forwarding samples for report MR. A. B. THOMSON of Marakona Estate has furnished the following report dated 13th May on his cotton trials made at Ukuwela:—

No. 1 Plot—Round boll similar to American upland, sown in nurseries from the Society's seed and planted out in the holes as soon as 2 leaves appeared on *November 20th* 1915. Spacing of planting 4 × 4 ft. No manuring was done but the land was forked and clean weeded.

The cotton started to ripen on *April 20th* 1916, but as yet very little has ripened sufficiently to pick.

A sample lot of 20 trees now contain 770 pods, average 38·5 pods per tree. One tree of this sample contains 144 pods, the height of the trees average about 4 feet and the branches spread very low, mostly lying on the ground.

The growth is healthy, especially in the sunniest portions of the plot. Portions of this plot planted in the shade of Rubber trees have not done well.

No. 2 Plot.—Long boll cotton similar to Sea Island sown in nurseries from seed collected from a 2 year old tree in a Marakona native garden and planted out on November 20th as No. 2 plot. Spacing 4 × 4.

No manuring done, but the plot has been forked and clean weeded.

The cotton here has only just begun to flower. The trees have grown to a height of 6 feet and are well shaped, but do not contain so many low branches as No. 1 Plot.

I lopped every alternate row to a height of 4 feet on May 1st and shoots are now coming out from below.

The growth is very healthy.

No. 3 Plot—Long boll cotton similar to above. Planted as seed at stake on October 1st from seed collected from a native tree at Kardy.

The pods started to ripen early in April but very little has been picked.

The trees do not show such good growth as No. 2 Plot, but the position is a little more shady.

The average number of pods per tree is 15.

These samples have been forwarded to the Director of the Imperial Institute whose report is awaited.

The following is a note on Rosea cotton (of which a small quantity of seed has been obtained for trial) by the Deputy Director of Agriculture, Western Circle, C. P., Nagpur:—

"The cotton crop of the Central Provinces and Berar consists of a mixture of 6 Varieties, 4 of which are *Neglectum* cottons, one an *Indicum* and the other an Upland Georgian or Hirsutum. In the year 1907 the Agricultural Department isolated the various varieties and tested one against the others.

The names of these varieties are as follows:

(1) Upland Georgian (*Gossypium hirsutum*)
(2) Bani ... ( ,, *indicum*)
(3) Rosea ... ( ,, *neglectum rosea*)
(4) Cutchica ... ( ,, ,, ,, *cutchica*)
(5) Malvensis ... ( ,, ,, *malvensis*)
(6) Vera ... ( ,, ,, *vera*)

"Of the 4 indigenous cottons, Rosea and Cutchica have white flowers and Malvensis and Vera have yellow flowers. Rosea and Vera have a narrow leaf with long narrow lobes, while Rosea *Cutchica* and Malvensis have a broad leaf with short stubby lobes.

"When these varieties were tested against each other, Rosea was found to give by far and away the highest weld and the highest ginning percentage. From the start it gave 40% lint to seed and by selection we have increased this to 41·5%. Its fibre is short, varying from ·7 to 1·1 inch, mostly about ·9. The lint is strong and coarse and very white and by reason of this last quality it fetches a higher price in the market. The cotton bolls are large and open well so that the cotton is easily extracted without taking with it parts of the dead boll. For this reason it is usually clean and free from leaf.

"Nothing is known about its origin, but it is supposed to be indigenous to Berar although some contend that it was introduced from the neighbouring Province of Khandesh in Bombay Presidency. Rosea does best in a place where the rainfall varies from 25 in. to 30 in. It is very susceptible to water-logging and "wilt" disease and this is one of the greatest difficulties we have to contend with.

"It was only about the year 1910 that the Department commenced to advocate the growth of Rosea cotton by the cultivators and in this short time.

fully one-third of the whole cotton area of the C. P. and Berar has been sown with this variety in the current year. The limiting factor was the supply of pure seed. The area goes up by leaps and bounds every year and it will be only a matter of 5 or 6 years till the whole of the cotton area is grown with this variety."

The following circular has been issued to the Government Agents and Assistant Government Agents :—

"With a view to the encouragement of cotton cultivation, I have the honour to enquire whether you could arrange to purchase for cash, through your headmen, good clean seed cotton (Sin. "Kapu" as distinguished from "Pulun" or stuffing cotton) at 10 cents per lb. or Rs. 11·25 per cwt.

The cotton should not be stained or otherwise discoloured and should be free from dirt and other impurities.

The cotton should be delivered at your Kachcheri at the price quoted and on hearing from you what quantity you have collected at the end of the next cultivating season (September-June), I shall make a remittance to cover value and give directions as to forwarding, etc.

Please be so good as to make known the fact that the Society is prepared to supply seed free of cost for planting, which should be done in October."

## TOBACCO.

A second station, for studying the possibilities of improved tobacco-growing in the Dumbara district, is likely to be established early next year.

The variety that is being cultivated here is a Cuban type introduced some 40 years ago, and it has lent itself to the manufacture of a mild cigar which is at present in demand owing to the high price of imported tobaccos. Cigarettes are also being turned out and find a ready sale.

It is not generally known that pipe tobacco (in stick form) made from Dumbara tobacco is being prepared on a comparatively large scale. It is of the black Cavendish type and appeals to the taste of a certain class of smokers. This tobacco is offered for sale in Kandy and Colombo and is purchased by sailors and others who like a strong smoke.

## THE FLORIDA VELVET BEAN.

Seeds of the Florida velvet bean were distributed to a number of members to test its suitability as a cover crop and green manure.

The Manager of the Peradeniya Experiment Station reports :—The Florida velvet bean was here sown on land containing a good deal of lime and has made an astonishingly fine growth with a very heavy crop of pods. Among wide-grown products such as coconuts or rubber I should say it is an excellent cover crop. I intend to try it in a new coconut clearing at Anuradhapura, where it is growing well in a plot, though not quite so luxuriantly as here.

MR. JOHN RUDD writes :—Owing to a scarcity of labour I was only able to sow a small quantity of the seeds but these have germinated and are likely to do well. I hope to set out the seed on a regular system during the October rains.

DR. H. M. FERNANDO reports that he did not find it a success as a cover crop in coconut land in the Chilaw and Western Section of the Kurunegala District.

MR. KELWAY BAMBER writes :—It is an excellent cover crop if prevented from going up the leaves of young palms. It can be rolled up once or twice a year and mulched in rings round the palms at gradually increasing distances, the previous decayed mulch being dug in.

MR. A. DRIEBERG reports that the seeds did not germinate well at Homagama.

The different species of Velvet beans are valued as a cover and renovating crop, as well as a fodder crop in which the pods are the most important part. They are hardy plants (almost too rampant) immune to wilt disease and root galls caused by nematodes: while they add an appreciable quantity of combined nitrogen to the soil in which they are cultivated.

## CINNAMON BARK OIL.

At the request of Prof. Dunstan 16 oz. of a pure sample of this oil, specially distilled for the Society at a cost of Rs. 3/- per oz., was forwarded to the Director of the Imperial Institute, who reported on it as follows:—

"The sample weighed about 1 lb. and was of good colour and aroma, but slightly cloudy owing to the presence of a small amount of suspended solid matter. On analysis the oil gave the following results:—

| | |
|---|---|
| Specific gravity at 15°C ... ... | 1·032 |
| Optical rotation ... ... | 0·7° |
| Refractive index ... ... | 1·585 |
| Aldehydes, per cent. ... ... | 69 |
| Phenols, per cent. ... ... | 6 |

Solubility in 70 per cent. alcohol: soluble in 3·2 volumes at 15°C.

"These results show that this is a normal cinnamon bark oil of good quality.

"As it was desired that the sample of oil should be sold, small specimens were submitted to a number of firms, who were asked to quote a price. It should be understood that it is not at all easy to obtain quotations for such a small quantity of oil, and this difficulty was increased by the fact that nearly all the Ceylon cinnamon bark oil which has reached this country in recent years has been adulterated. Moreover, British firms look with suspicion on much of the cinnamon bark oil of German origin which has been sold at low rates in this country in recent years, and subsequently a tendency has grown up to pay good prices only for oil distilled in Great Britain. The offers at first made for this sample of cinnamon bark oil were from 24*s.* to 25*s.* per lb., but finally one firm offered 40*s.* per lb. in order to obtain the sample for experimental purposes."

"Though this price was less than the oil cost to produce in Ceylon, viz., 55*s.* per lb, it was accepted as it seemed worth while to have the oil purchased on an experimental basis, as the firm in question might after trial be induced to take further quantities at a better price.

"This expectation has been realised, and the firm has now offered to purchase from 28 lb. to 56 lb. of the oil at what Ceylon distillers may consider a fair price.

"As a guide to the interpretation of the term 'fair price,' I may say that the information as to the probable cost of the oil, given in your letters to me dated the 26th and 31st August, 1915, was supplied to the firm in question The offers mentioned in these letters range from Rs. 2·50 to Rs. 3/- per ounce, whilst your letter of the 18th November, 1915, states that the sample of oil now under report cost 55*s.* per lb. to produce.

"The offer now made is for a small quantity of oil only, but from enquiries that have reached me from other quarters, I have no doubt that other offers can be obtained if oil equal in quality to the present sample can be produced, and British firms are given an opportunity of experimenting with it. I think therefore that it would be worth while for a firm in Ceylon to distil about 56 lb. of the oil and forward it to the Imperial Institute for disposal to the best advantage.

"There is understood to be a great scarcity of pure cinnamon bark oil on this market at present, so that this is an exceptionally good opportunity for Ceylon producers to enter this market under favourable conditions, if they take prompt advantage of the present position."

The Chairman of the Low Country Products Association and other authorities were consulted about the matter, but in view of the fact that pure bark oil cannot be purchased for less than Rs. 3/- per oz. and the value realised by the 16 oz. sent to London worked out only Rs. 2·50 per oz., the Imperial Institute was informed that there was no encouragement for cinnamon planters to distil oil for the London market at the latter price.

## STRYCHNOS SEEDS.

Samples of *S. Nux Vomica* (the source of strychnine) and *S. Potatorum* (the clearing nut) received from the Eastern Province were forwarded to the Imperial Institute for report. Professor Dunstan writes :—

"There is a regular market for *Nux Vomica* and no demand for the other (*S. Potatorum*). At the last monthly drug auction, which was held in London on the 4th instant, small dull *Nux Vomica* seeds sold at twenty-eight shillings (28*s.*) per cwt. The price throughout the year 1915 ranged from 13*s.* 6*d.* to 22*s.* 6*d.* as against a range of from 8*s.* 9*d.* to 20*s.* per cwt. in 1914. The present high price is largely due to the freight charges now ruling. The supply of *Nux Vomica* comes chiefly from India, the commercial grades being known as Calcutta, Madras, Bombay and Cochin seed."

*Nux Vomica* seed is chiefly collected from the forests of the Badulla, Anuradhapura and Kurunegala districts, after purchasing the right to do so from the Forest Department.

The Government Agricultural Chemist reports as follows on the peculiar properties of *S. Potatorum* (*Ingini* Sinh.) in clearing water : "With reference to your enquiry *re* above for purifying water, experiments show that the effect is wholly mechanical. On placing the seeds in water they swell up forming a gelatinous mass, carrying any suspended matter to the bottom of the vessel. After extracting the seeds the same effect is noted. The extract has no chemical effect in clearing water."

## LAC.

Mr. Karunanayake, Agricultural Instructor, Matara, writes after a visit to Angurumaduwa (Tangalla district), one of the few centres of lacquer work : "The quantity of wild lac available here is on the decrease, and the number of workers has now dwindled down to 3, the rest taking to other industries such as carpentry. I would therefore be glad if you could arrange for another consignment of brood lac from India for purposes of inoculation."

Application has been made to the Imperial Entomologist India with a view to secure fresh brood lac for both Masan (*Zizyphus jujuba*) and Kon (*Schleichera trijuga*), and a supply is expected early next year.

Mr. Molegode, Agricultural Instructor, reports similar shortage of lac for workers in the Central Province, and in order to meet the urgent demand an order has been placed for Indian lac which will be offered for sale at cost price.

## APICULTURE.

There exists some difference of opinion as to the suitability of comb-foundation for *Apis Indica* bees made from wild comb wax with the aid of the machine specially constructed for the Society by an American firm.

Lt. Cousins, the Adviser to the Government of Punjab, reported unfavourably on the sheets sent to him by the Society, chiefly condemning the quality of the wax, and stated that he found English comb-foundation (intended for *A. mellifica*) answer his purpose.

Mr. M. Shanks, who acts as adviser to the Society, has kindly made the following report:—

"I have given sheets of comb-foundation of *A. Mellifica* to *A. Indica* and have had combs drawn out, but found them a failure. The cells were all misshapen and this was also the experience of a well-known beekeeper

in Nuwara Eliya, who showed me his combs with cells similarly deformed. I have frequently put a ½ in. strip of English foundation along the top bar of frame to act as guide. This is all right and plain wax is also suitable for that purpose. I find the foundation sheets supplied me from the Stock Garden excellent. The combs are quickly drawn out and a greater number of bees can work on them, as the bees draw out all the cells simultaneously, which of course is impossible where only "starters" are employed. Another very great advantage is that the supply of drones can be controlled. I find that the bees, where they are not given foundation (for workers) waste a great amount of time and material in rearing a large number of useless drones.

"I had a very strong colony of native bees (2 stories, 24 frames, mostly drawn out from foundation supplied by you) without a single drone in the hive. When my stock of foundation ran out, I put an empty frame between two combs in the brood chamber; and after the bees had started making the comb I took it out and put it in the top storey and allowed the bees to complete it there. Being away from the brood I never found the queen to have laid there. It is quite possible MR. COUSINS' bees are larger than ours and it would be interesting to find out from him the number of cells per square inch in the combs made by the bees when left to themselves."

A copy of this report has been forwarded to LT. COUSINS, and in the meantime an order has gone to Australia for a supply of pure wax to be used for making foundation.

## INTRODUCTIONS.

Seeds have been distributed to suitable localities of a new species of CYPRESS *(Cupressus glabra)* known as the smooth Cypress received from the U. S. A. Department of Agriculture.

The tree is small ranging from 25 to 30 feet in height and 10 to 14 in. in diameter. The timber is durable and is employed for fence posts, log cabins, fuel, telephone poles, etc. It thrives best at elevations of between 3,500 and 5,500 and in protected watered ravines or gentle slopes where there is moisture. It will, however, grow at lower elevations, associated with and protected by other plants. This Cypress is a prolific seeder and lives to a great age.

A quantity of PULASANG *(Nephelium Mutabile)* fruit was received from the Straits Settlements and seed have been put in nursery at the new Stock Garden at Peradeniya Junction.

Seedlings of the INDIAN MASAN or BHERE *(Zizyphus jujuba)* are also being raised.

CAPSICUM ANNUM received from the U. S. A. through the courtesy of DR. FAIRCHILD is being tried at Matale, Wellawaya, Jaffna, Madugoda, Kegalla, Padiapelella and the Society's Gardens.

PALU fruit procured through the Assistant Conservator of Forests, Jaffna, is being used for raising seedlings with a view to securing stocks for grafting Sapodilla on.

Seeds of the small RED ONION (SHALLOT) was imported and distributed to the following centres:—Jaffna, Matale, Panwila, Marassana, Padiapelella, Welimada, Haputale and several school gardens.

SUDAN DURA seed from the Experiment Station, Gannoruwa, has been distributed to Matale, Badulla, Wellawaya, Buttala, Dambulla, Naula, Nalanda, Urugala, Hataraliyadde, Udispattu, Kadugannawa, Galagedara, Hettipola, Jaffna, Kegalla, Wattegama, Galle, Matara, Hambantota, Tangalla, Achchuveli, Nedunkerni, Mantai, Alaveddi, Tellippalai, Kaithadi, Kachchai, etc. The varieties included the red, white and yellow.

Seed of what is known as NAGPUR CHILLI received through the Economic Botanist, Central Provinces, India, was distributed among the Instructors.

Seed of NEDUN *(Periopsis Mooniana)* were secured through the assistance of the Mudaliyar of Rayigam Korale for a member who proposes to grow this timber tree.

CORIANDER seed received from India is being tried at Kegalla, Balangoda, Hettipola, Weragoda, Ambalantota and Mediwaka.

### MISCELLANEOUS.

In response to an enquiry from a member resident in the Southern Province with reference to TREATMENT OF OLD CITRONELLA LAND to be planted with rubber, the Government Agricultural Chemist wrote:—"Most of the citronella land is exhausted and should be well limed and dug after the grass is burned off. The 4 oz. of complete mixture per hole should be supplemented with 2 or 3 oz. of wood-ashes if available, to supply the necessary potash; 20 ft. by 20 ft. is a good distance for the rubber if interplanted with Albizzias to protect from wind. *Tephrosia candida* can be sown in rows 2 ft. apart up and between the rubber and should be cut and mulched regularly in gradually increasing rings round each tree. Large holes should be dug for the rubber and the land drained to prevent wash."

A correspondent from India enquired whether TEA could be grown (1) at Sea level or on slopes near the sea, (2) under artificial irrigation during dry weather (3) with a rainfall of 100 in. during four months of the year. To which the Government Agricultural Chemist replied.—"(1) Yes. There are similar conditions at Ragama and in the Kelani Valley. (2) Whether tea will grow under irrigation remains to be proved. A trial is being made at the Dry Zone Experiment Station, Anuradhapura. Tea, however, likes a moist atmosphere as well as water at the roots. (3) With Irrigation and shade (Dadaps and Grevillea) it would probably succeed where the rainfall is 100 in. Points to be considered are character of soil, liability to wash, drainage, etc."

Peradeniya, 3rd Oct., 1916. C. DRIEBERG, Sec.

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## SIMPLE STILLS FOR ESSENTIAL OILS.

With increasing attention to the production of the essential oil of Bay leaf and other essential oils, there arises a demand for a convenient type of still. In the WEST INDIAN BULLETIN, Vol. IX. p. 276, suggestions were made for simple stills, two forms being described. Both types have been in experimental use for a number of years. As a result of this experience it is found that the simple still of the first type there described is quite satisfactory in operation, but it has the defect that it soon corrodes and has to be entirely renewed.

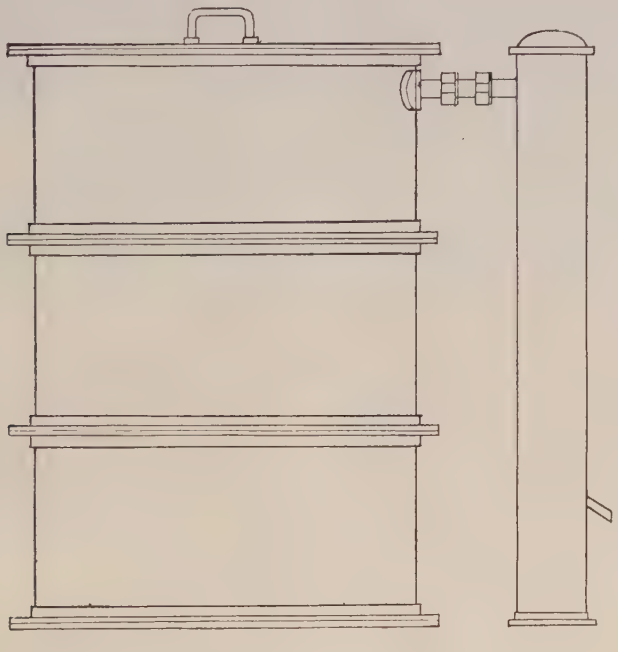
It occurs to the writer to suggest that if the still is constructed in segments, the corroded parts may be readily renewed at little expense and with little loss of time. Furthermore, should it be required to increase the capacity of the still, this may be done by adding segments.

A still of the kind suggested is shown in the accompanying illustration. It consists of segments formed by riveting sheet-iron to rings of angle iron, thus forming hollow drums which can be bolted together one on top of the other until a still of the required capacity is constructed. The bolts connecting the segments can be disconnected at any time for the replacing of a segment, while the joints between the rings can be made tight in the usual manner with asbestos or other packing.

The sides of the drums may be made of sheet-iron of $\frac{1}{8}$-inch thickness. The bottom of the still should be made of thicker material, and may be of $\frac{1}{4}$ or $\frac{3}{8}$-inch iron sheet. In mounting the still over the fire-place, the ring

with the bolts should be embedded in the mason work so as to protect it from the direct action of the fire. This will reduce the difficulty of removing the bolts when it becomes necessary to renew the bottom plate.

The top of the still should also be made of $\frac{1}{4}$-inch to $\frac{3}{8}$-inch iron sheet; it should be held in place by bolts and nuts (not shown in the drawing); these should be placed sufficiently close together to make a good joint, which may also be fitted with asbestos packing. A coating of blacklead on the cover will prevent this from sticking to the asbestos, and in this way the joint may be broken and renewed without difficulty.




Scale, $\frac{1}{2}$-inch = 1 foot.

If the top bolts are permanently fixed in the angle iron ring they will always be in place and cannot be lost; the nuts may be winged so as to enable them to be screwed down by hand without the use of a spanner.

Connection with the condenser may be made through the side of the upper segment and near the top. This is preferable to making the connection through the cover, for in this way the joint has not to be broken when the cover is removed.

In the drawing the still is shown connected to an "Ideal" condenser. As this is made of copper, it is suggested that the connection between the still and condenser should be made by means of a short length of flanged pipe made of vulcanite, so as to obviate galvanic action which would be induced by the contact of iron and copper, and would lead to the corrosion of the still.

The still is operated in the manner described in the West Indian Bulletin above referred to. A perforated grating is fixed in the bottom segment at a convenient distance from the bottom; a sufficient quantity of water is placed at the bottom of the still and the leaves or other material placed above the grating. For convenience in handling and removing, the leaves may be contained loosely in cages or baskets of iron wire; these

baskets can be lifted out by means of the same hoist which is used to remove the cover, and this can be done without waiting for the still to cool.

The hoist referred to may consist of a simple wooden tripod standing over the still, and provided with a pulley and hoisting rope.

If the discharge orifice of the condenser can be placed at a height of some 3 feet or so above the level of the water in the still, it is possible to arrange that the distilled water separating from the oil in the Florentine flask, commonly used as the collecting vessel, may be conducted by a pipe directly back to the still, thus maintaining a constant water-level in the still and obviating the risk of burning from lack of water; at the same time it automatically leads to the recovery of any essential oil that may inadvertently escape in the waste water. To effect this, the condenser should be placed relatively much higher than is shown in the accompanying drawing: this may readily be done by lengthening the pipe connecting the still with the condenser.—"F. W." IN AGRICULTURAL NEWS.

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# THE DATE PALM IN EGYPT.

T. B. BROWN.

(*Continued from page 198, Vol. XLVII.*)

## FEMALE PALMS.

The female trees commence flowering at the beginning of March. The time of flowering varies with different kinds and with individual trees. Before female palms can produce fruit the flowers must be fertilized with pollen from the male palms. In a state of nature there would probably be as many male as female trees in a grove, and in consequence a much greater quantity of pollen would be produced than is the case in a grove planted by hand where the object is to reduce the number of male trees to a minimum. With such a profusion of pollen the female flowers would no doubt be sufficiently fertilized by natural agencies to produce an abundance of seed. In our artificial plantations, however, where the maximum quantity of fruit must be obtained from the area cultivated, it is necessary to resort to hand pollination. This is done as follows. As soon as the spathe (*Ar. relaf* or *gerab*) of the female bunch (*Ar. sobata*, *ginoo*, *aisa*, *goorbâha* or *argoon*) has opened slightly, it is split. A few branchlets of staminate flowers are taken and tapped smartly with the finger and thumb to release the pollen among the flowers of the female bunch. When this is done the male branchlets are placed in the middle of the bunch. At Salhîa and Qoorein the pollen branchlets are twisted together in such a manner that they can be placed on the end of a stick and inserted in the middle of the bunch by this means. When the female flowers have been placed in the centre of the fruiting bunch as described above, it is customary in some districts to bind the branches (*Ar. shamrûkh* or *shoa shoa*) of the latter loosely together with a palm leaflet to prevent the escape of the female flowers. This practice, however, is not universal. In some districts it is not done at all, whereas in others one variety is tied and other varieties are left loose. It appears to depend on (1) the force of the wind to which the trees are usually exposed, (2) the nature—compact or loose—of the fruit bunches of the varieties which are cultivated, and (3) the energy of the cultivators. At Marg the bunches of the *Amri* are tied, but not those of the *Hayâni*. In Giza Province, on the other hand, the *Hayâni* is always tied. In the Western Oases three to four ties are placed around each bunch of the *Sa'îdi*, *Khramrâwi*, and *Falîg*, although other varieties receive no attention in this respect. At Edku it is usual to bind bunches of both the *Samâni Zaghlool*.

Some cultivators bind the leaflet in such a way that the bunch releases itself as it grows, others climb the palms and remove the tie by hand. This is usually done when the little unfertilized fruits begin to fall, and the good fruits are seen to be swelling. The fruits which fall when they are quite small are known as *Nîni* or *Sagatan Defigh*. Those which fall in a more advanced state are called *Râmikh* or *Defigh*. Sometimes all three carpels of the ovary grow and develop into small fruits with badly formed seed or no seed at all. These are known as *seesi*. They usually remain on the tree until they are gathered with the ordinary fruits. Female trees are occasionally met with which are almost entirely sterile. The flowers of such trees are for the greater part incapable of being fertilized and the number of fruits which are produced is in consequence too small to repay the work of pollination. All the bunches of a tree do not open at the same time, those which are situated highest on the trunk opening before those below. It is therefore customary to visit the trees two or three times in order to pollinate each bunch at the right time. When all are finished a piece of palm fibre *(Ar. leej)* is tied to one of the leaves to denote the fact to the operator afterwards. Old palms which have reached a great height are usually visited twice, not only because of the work involved in climbing them but because they do not as a rule bear as many bunches as younger trees, and there is therefore less necessity of extending the pollinating operations over a long period. *Sîwî* and *hayâni* are, however, almost always visited three times.

Fruit-bearing trees occasionally flower twice each year, the second crop of flowers appearing during the seasons of high Nile when the fruit of the spring crop is approaching maturity. Where trees of this kind exist, pollen is sometimes kept throughout the summer to fertilize the late flowers, but the fruit obtained is rarely of much value, at least in the Delta. MR. R. W. BRIGSTOCKE, however, reports that there are four to five trees at Aulâd Tôq Sharq, Baliana, which ripen fruit in the month of March. I have not seen these trees, but the appearance of the seed gives me the impression that the fruit is well developed. In the warmer part of the country it might be possible to cultivate these trees for the production of out-of-season fruit.

A male inflorescence of average size is reckoned as being sufficient to pollinate all the fruit-bearing bunches of five palms which are ready for fertilization on one day. Some trees of course require more pollen than others. The early bunches of any variety are larger than those which come later in the season and therefore require more pollen. The quantity of male flowers required is not, however, regulated entirely by the size of the fruiting bunch. Some varieties require much more pollen than others irrespective of the above consideration. For example it is necessary to use much more on the *Sîwî* than on the *Amhât* although the bunches of the latter are equal in size to those of the former and contain as many fruits.

The work of pollination is known as *Tadkîr el nakhla*. It is finished in the month of April.

What is called *taqwees el nakhla* is carried out in the months of June, July and August, according to the season at which the variety matures its fruits. Whereas early varieties such as the *Hayâni* may be done in June, late varieties such as the *Aglâni* may not be done until August. The operation consists of bending the fruit bunches forward and tying them to the mid-ribs of the leaves, in order to facilitate the gathering of the dates. It must be done before the stems become hard, otherwise they may be broken in the process. In the case of certain varieties which have fruit bunches with thick stalks, the latter are split in order to obviate the danger of breaking them. This practice is followed most commonly at Salhiâ and in the surrounding districts of Sharqîa. The bunches are of course tied to the leaf stalks after being split, and the latter serve as supports when the fruit swells and becomes heavy. The varieties *Aglâni*, *Sergi*, *Hamra Abu Kheir* and *Cabooshi* have comparatively

thin and supple fruit stalks. These are therefore bent over and tied to the leaf stalks without being split. In the case of *Amri* and certain other varieties, the bunches of which are not tied to the leaf stalks, they are sometimes supported with forked sticks (*Arshe âba*) resting on the trunks of the trees. This is done more especially where the bunches are heavy and the leaf stalks slender. The manner of tying the bunches also varies according to the variety. The bunches of the *Amhât* and *Hayâni* have comparatively short stalks, consequently they are tied to the leaves at the point where the fruiting branchlets arise. The bunches of the Sîwi, on the other hand, have long stalks, so that they are tied at a point some distance below that at which the fruit branchlets are given off. The less careful cultivators often neglect entirely to tie the *Aglani*. The *Bint Aisha* is also seldom tied but it is always done in the case of the *Samâni* and *Zaghlool*.

At Aswân the dates are never tied to the leaves, but a leaf stalk is made to pass between the fruit-bearing branchlets of the bunch and thus act as a support for the latter as the weight of the fruit increases. Another method largely followed in the Oases is to draw two leaves together from opposite sides of the palm, and to cross them so as to form a fork in which to rest the *rachis* or stalk of the bunch.

The date palm may bear as many as twenty bunches or even more. The best cultivators, however, restrict the number which are allowed to ripen fruit. The bunches which are removed are usually those at the top of the tree. They are taken away at the time of the *taqwîs*. The number of bunches which are allowed to remain on the *Samâni* is five to six. Good trees of *Hayâni* and *Bint Aisha* are allowed to carry five to eight bunches, according to the strength of the trees, while the *Zaghlool* matures as many as ten. Generally speaking, where no thinning of the fruit is done there is a regular alternation of good and bad crops. In fact some trees do not bear at all during the year following a good season. This, however, is considerably modified in districts where some of the late varieties with sweet fruit such as the *Zaghlool* and *Samâni* must have their bunches surrounded by nets to protect them against birds and flying foxes. In districts exposed to high winds it is better to surround the bunches with canvas which prevents the fruit being eaten by birds or blown off by the wind.

In the Western Oases a good substitute for the canvas is made of the desert plant known as Camels' Thorn *Alhagi Maurorum* (*Ar. Agul*). A close net-work of this plant is bound round each bunch, the fruit of which is thus well protected from the effects of the strong winds blowing from the desert. Sometimes two bunches which are hanging together are enclosed in the same cage. Date palms yield the heaviest crops when they are between twenty and fifty years of age.—THE AGRIC. JOUR. OF EGYPT.

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## PONGAMIA GLABRA (VENT).

### "MAGUL-KARANDA" S. "PUNKU" T.

A moderately large-sized leguminous tree (the only species of its genus) found to occur commonly in the tidal and beach forests of the Indo-Malayan region and extending even to Australia. It is thus adapted to adverse conditions in its natural habitat, the roots being often in salt-water and at other times undergoing extreme desiccation. Whenever occurring inland it should be considered as planted (Prain. As. Soc. JOURN. BENGAL. vol. 66. p, 456) or derived from self-sown seeds of trees that were planted.

In Ceylon, TRIMEN states that it occurs along the banks of streams and rivers in the low-country.

The leaves and twigs are used in the Madras Presidency as manure for rice-lands being trampled down into the mud before the seed is sown. This may account for the tree found occurring in Ceylon "on the bunds of old tanks in dry districts" (Lewis) where they must have been at first planted for some such purpose.

The leaves are large and borne on long and thick stalks possessing three or four pairs of leaflets with one terminal leaflet. The flowers are small and of a pale pink or greenish-pink colour, sometimes also white. The flowers appear in pairs or axillary racemes about April-May just at the time when the new leaves also appear.

The tree is rarely bare of foliage for more than one month. The pods are one-seeded, woody, indehiscent and are never winged.

The seeds yield on extraction 20-25% of a reddish-brown (yellowish when pure) thick oil possessing marked antiseptic properties. Hence its use is indicated in scabies, herpes and other skin diseases. It is also used as an embrocation for rheumatism. The oil has a bitter taste, the bitter principle residing in a resin and not an alkaloid as in Margosa oil. The oil is also used for lighting purposes and sells in Calcutta at about Rs. 11/- per cwt. (*vide* R. S. Pearson: "Commercial Guide to the Forest Economic Products of India," 1912).

The oil-cake forms a valuable manure and as such is worthy of note in our dry districts. In the Bombay Presidency as *Karanj* cake it is known as the cheapest form of oil-cake for manurial purposes. It should form a good substitute for castor-cake. Samples on analysis contain 3·5 to 4% nitrogen. Whilst containing as much potash as castor cake it is slightly poorer in nitrogen and contains only about half the percentage content of phosphoric acid. In India the tree is commonly seen planted along roadsides and the right to collect seed is sold by contract.

The leaves are also used as poultices for foul ulcers and has even been credited to be of value as fodder for milch cattle! Dr. Bancroft, however, states that all parts of the plant contain a principle of great activity as an emetic (Proc. R. S. New South Wales—1886. p. 70).

The tree is known in Australia as the "Indian beech," its wood is, however, valueless, being readily attacked by insects.

HENRY L. Van BUUREN.

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## RUBBER, COCONUT AND COFFEE CULTIVATION IN MALAYA.

According to information received at the Commercial Intelligence branch of the Board of Trade from the Malay States Information Agency in London, a recent report by the Acting Director of Agriculture (Mr. E. S. Hose) on agricultural development in Malaya states that the larger profits attending the cultivation of rubber continue to form a serious obstacle to the development of other agricultural products, although it is well known that the climate and soil of Malaya are favourable for the growth of a large number of tropical plants of first-rate economic importance. Among such plants that have received the attention of the Department during the past year were the African oil palm, camphor, tea, coffee, ipecacuanha, cotton, wild ginger, and cardamoms for paper making, croton oil, eucalyptus, Brazil nuts, date palm, ground nuts, etc.

Rubber.—Excluding the Straits Settlements (for which statistics had not come to hand when the report was written), but including the other States of the Peninsula under British protection, there were 703,535 acres

under rubber on estates of 100 acres and over at the end of the year. The acreage actually producing rubber was 347,750, as compared with 248,456 in 1914. The rubber crop of the Federated Malay States for 1915 is returned at 36,380 tons, and to this must be added 6,666 tons from other States under British protection. It would probably be safe, writes Mr. Hose, to add 8,000 tons for the Straits Settlements, making a total of about 51,000 tons for Malaya. It must be remembered, however, that these figures are only in respect of properties of 100 acres or more in area, no account being taken of the output of rubber from small holdings. The exports of rubber from the Federated Malay States in 1915 were 44,523 tons, while the total rubber exports from British Malaya are put at over 68,000 tons.

Coconuts.—Statistics of coconut cultivation show that there were 82,250 acres under coconuts in 1915, exclusive of the Straits Settlements. The area for the Federated Malay States was 54,822 acres, as against 58,027 acres in 1914.

Coffee.—In 1915 there were 6,085 acres under coffee in the Malay Peninsula (exclusive of the Straits Settlements), of which 4,312 acres were in the F.M.S.

Experimental Work.—A number of oil palms in bearing at Kuala Lumpur for the past two years gave a yield of from 35 to 45 lb. of nuts each palm per annum, and experiments are being made with varieties obtained as seedlings from Nigeria. Successful experiments have been made on the See Kee Estate with Caravonica cotton; a sample of the cotton separated by hand gave 67·5 per cent. cotton seed and 32·5 per cent. lint. Sisal hemp and other fibre plants have shown excellent growth on Gunong Angsi and at Kuala Lumpur, and with a good stock of fibre producing plants now available for experimental purposes, it is hoped shortly to make use of the decorticating machinery installed for this purpose. An experimental plant has also been set up to test the value of wild ginger and cardamoms for paper-making.—

Board of Trade Journal.

## COMMITTEE OF AGRICULTURAL EXPERIMENTS.

At the meeting of the Committee of Agricultural Experiments on Thursday, Sept. 7th, held at Gangaruwa,

The Chairman—brought up the question of utilising rubber seed for oil extraction, with reference more especially to the price at which it would pay planters to have the seed collected and delivered in Colombo, citing Rs. 35 as the price offered some years ago.

There was general agreement that it would not be remunerative at that figure.

Mr. Sheridan Patterson—stated that he had found the cost of collection 10 cents per thousand. It was remarked that the total crop was spread over some four or six weeks, and that though the cost of collection might be small when the maximum fall of seed occurred, the average, if the whole crop were to be collected, would be considerably greater. At 10 cents per 1,000, allowing 400,000 to 450,000 seeds to the ton, the cost of collection alone would be R40 to R50.

### TEA EXPERIMENTS.

Mr. Bamber—described the new experiments recently begun on the tea-plots at Peradeniya. Experiments had been conducted on the plots for several years to demonstrate the effects of various green manures, and a change had now been made to a series of experiments to ascertain the effect of Potash, Phosphoric acid, and nitrogen, alone and in combination with lime.

Comparatively large doses of manures would be employed in order that the effect might be clearly evident. He mentioned that the dadap plot had recently shown a decreased yield and was in need of lime.

In this connection an interesting discussion arose on the question of the common Kora Weed (*Cyperus rotundus*)

Mr. Bamber—stated that although the covering of sweet potatoes, when growing, kept the weed down, it did not kill it, and when the cover was removed, the weed appeared as before. Frequent weeding had also failed to get rid of it. In some patches the bushes were killed out by the weed, and he suggested that this was due to some poison in the plant. It was probable that as sedges, such as *Cyperus rotundus*, usually grew in an acid soil, liming might have some influence upon it; this would be ascertainable from the experiments now in progress. Mr. Beven drew attention to the fact that the bulb of Kora (Sinhalese *Kalanduru*) is a well-known Sinhalese poison and medicine.

## COFFEE.

The Chairman—stated that four of the newer kinds of coffee, viz., Uganda, Quillou, Canephora and Robusta, from authentic seed, were now growing on the Experiment Station, but they were as yet too young to afford any data regarding their relative yields.

In response to questions, he stated that no variety of coffee was immune from leaf disease, though the newer kinds suffered less than *Arabica* and they might not be attacked in the younger stages of growth.

## TEFF GRASS.

This was stated to be growing well at the Dry Zone Experiment Station, Anuradhapura. It has proved a valuable fodder in South Africa.

## COCONUTS.

The question of ploughing coconut estates, discussed at the previous meeting, was again brought forward.

Mr. Beven stated that he had ploughed close to the stems on estates on sandy, clayey, or gravelly soil, deep between the trees, but shallow near the stems, without any damage to the trees. In some cases there might be a slight set back, but it was only temporary.

The Chairman pointed out the apparent difference of opinion was to some extent due to the brevity of the minutes of the previous meeting, as it was then agreed that the set back which might follow, when the land was ploughed close to the stems, was not permanent.

There was, however, general agreement that it was not necessary to plough close to the stems as the tips of the main feeding roots would be further out.

In this connection the discussion revealed a decided difference of opinion concerning the behaviour of coconut roots when severed by the plough. On the one hand it was contended that severed roots died back completely to the stem, new roots being produced in their place; on the other it was maintained that the severed root produced a new tip, at or near the point of severance.

The Chairman promised that observations should be made to settle the question. It may be noted that it is possible that there may be a difference between behaviour of long and short roots in this respect.

Mr. Panditteseker brought to the notice of the members the death of single trees, in which the crown gradually dwindled until the tree died, the surrounding trees remaining quite healthy.

Lightning was suggested as a possible cause.

Mr. H. L. De Mel submitted for consideration the practicability of protecting coconut trees from lightning by means of lightning conductors and cited a case in which two conductors had been erected and appeared to give protection for some years, but had failed to protect the trees during last year.

It was generally agreed that damage by lightning had been more prevalent last year than in years immediately previous. The limited area protected by each conductor was considered to negative any possibility of employing them for the purpose proposed. According to current theory, coconut trees are damaged by lightning when the lightning occurs before the rain. When the stems have become wet, they are efficient conductors. Sir Emerson Tennent claimed that native huts owed their immunity from destruction by lightning to the coconut palms which surrounded them. As the terminal cone of every coconut palm provides a point of discharge, a lightning conductor could scarcely be effective unless it were abnormally high.

## HEVEA DISEASES.

Several items concerning Hevea diseases having been placed on the agenda, the Chairman exhibited and described *Fomes semitostus*, *Poria hypobrunea*, *Ustulina zonata*, fruit disease caused by *Phytophthora Faberi*, and fruits attacked by *Glœosporium alborubrum*. In the course of his remarks he stated that it had now been demonstrated that *Fomes semitostus*, *Ustulina*, and *Poria* could develop on the rubber stumps left after thinning out, and that it was highly important that rubber stumps should be uprooted, or extracted to a depth of about two feet. This advice had been given by the Mycologist since 1906. *Fomes semitostus* had also been found to develop on the stumps of abandoned tea under rubber, and to spread from them to the rubber : tea under rubber should, therefore, be uprooted when it becomes unprofitable. *Fomes* also develops on stumps of Ficus, Jack, Halmilla, Ceara, and in old bamboo clumps. *Polyporus zonalis*, a fungus which closely resembles *Fomes semitostus* was also exhibited and the difference between the two explained. *Fomes semitostus* when fresh, is orange red beneath, with a yellow margin, and the section of the pores is red or redbrown ; *Polyporus zonalis* is white or lurid grey beneath, with a white margin, and the section of the pores is usually pale. Some forms of *Polyporus zonalis*, however, closely approach *Fomes semitostus* and when dry the two species are almost indistinguishable, even by experts. *Polyporus zonalis* is not parasitic.

The fruit rot and leaf fall which has recently attracted so much attention is caused by the fungus *Phytophthora Faberi*. The fungus first develops on the fruits. Next it attacks the leaf stalk, and causes the leaf to fall. The point of attack on the leaf stalk is usually indicated by a brown ring. It may also attack the green branches and cause them to die back. When the spores fall on the stem, they produce the well-known Hevea Canker. The prevalence of this disease is undoubtedly influenced by the amount of rain, and the unreasonable rains of the year have caused it to appear in districts which are usually free from fruit disease. Stem Canker may be expected to occur later in the year, as a consequence of the fruit disease.

In the discussion which followed the need of greater publicity was urged by several members, and it was decided that the Botanist and Mycologist should give a lecture and demonstrations of Hevea Fungi in Kalutara, Kelani Valley and Ratnapura at an early date. It was also considered of the highest importance that coloured figures illustrative of these diseases and the fungi which causes them should be published.

# BOARD OF AGRICULTURE.

Minutes of a meeting of the Board of Agriculture held at the Town Hall, Kurunegala, on 3rd October, 1916.

The Government Agent, N.W.P. (MR. C. R. CUMBERLAND) presided.

There were present the Acting DIRECTOR OF AGRICULTURE, GOVERNMENT AGRICULTURAL CHEMIST, the TOBACCO PLANTER, the HON'BLE MR. T. B. L. MOONEMALE, DUNUWILE DISSAVA, DR. H. M. FERNANDO, MUDALIYARS P. A. C. EKNELIGODA and A. E. RAJAPAKSE, MESSRS. A. W. BEVEN, H. L. DE MEL, LT.-COL. T. G. JAYEWARDENE, RATEMAHATMAYAS J. G. TENNEKOON, L. NUGAWELA, L. B. BOGAHALANDE, L. B. MADAHAPOLA, L. B. MADAWELA, AGRICULTURAL INSTRUCTORS MOLEGODE, KARUNANAYAKE AND NUGAWELA and the Secretary (MR. C. DRIEBERG).

The Secretary read the minutes of the previous meeting held at Jaffna on 29th February, 1916, which were duly confirmed.

Extracts from Progress Report No. LXX were read by the Secretary who further replied to certain questions with reference to Agricultural education. The report was adopted on the motion of DR. H. M. FERNANDO seconded by MR. J. G. TENNEKOON.

MR. H. L. DE MEL moved the following resolution :—

That this Board records with regret the death of three members of the Board of Agriculture :—MESSRS. JOHN CLOVIS DE SILVA, H. AMARASURIYA and MAHAWALATENNE RATEMAHATMAYA, and desires the Society to forward messages of condolences with the families of the deceased members. This was seconded by MUDALIYAR RAJAPAKSE and passed in silence.

The statement of accounts for the quarter ending September, 1916, was tabled.

The Chairman in his opening address welcomed the Society and indicated how it could help the Province.

The HON'BLE MR. MOONEMALE read a paper entitled "Adjustment of Coconut Cultivation in Kurunegala District." In the discussion which followed DR. H. M. FERNANDO, LT.-COL. T. G. JAYEWARDENE and MR. H. L. DE MEL took part.

MR. SCHERFFIUS addressed the gathering on the subject of tobacco cultivation. An interesting discussion followed on which the CHAIRMAN, DR. H. M. FERNANDO, MR. H. L. DE MEL, MUDALIYAR RAJAPAKSE, MR. A. W. BEVEN and TENNEKOON RATEMAHATMAYA took part.

MR. R. C. PROCTOR'S paper on "System of Land Tenure in Ceylon : Past and Present" was taken as read.

MR. N. WICKREMARATNE read extracts of a paper on the "History of the Co-operative Credit Movement in Ceylon." Questions on the paper were raised by the Chairman, DUNUWILE DISSAVA, DR. H. M. FERNANDO and MR. H. L. DE MEL and replied to by MR. WICKREMARATNE.

The Organising Vice-President (MR. PETCH) in summing up thanked those present for their attendance. He moved a vote of thanks to the readers of the papers and the Chairman for presiding on the occasion.

The HON'BLE MR. MOONEMALE in replying on behalf of the people of Kurunegala expressed their appreciation of the Society's visit.

C. DRIEBERG.

Peradeniya, October, 5th, 1916.

# MARKET RATES FOR TROPICAL PRODUCTS.

*(From Lewis & Peat's Latest Monthly Prices Current.)*

| | QUALITY. | Quotations. |
|---|---|---|
| ALOES, Soccotrine cwt. | Fair to fine | 100/ a 110/ |
| Zanzibar & Hepatic „ | Common to good | 60/ a 100/ |
| ARROWROOT (Natal) lb. | Fair to fine | 3½d a 4d |
| BEES' WAX cwt. | | |
| Zanzibar Yellow „ | Slightly drossy to fair | £7 10/ a £7 17/6 |
| East Indian bleached „ | Fair to good | £8 10/ a £8 12/6 |
| „ unbleached „ | Dark to good genuine | £6 a £6 15/ |
| Madagascar „ | Dark to good palish | £7 a £7 17/6 |
| CAMPHOR, Japan lb. | Refined | 2 4½ a 2/6 |
| China cwt. | Fair average quality | 150/ |
| CARDAMOMS, Tuticorin | Good to fine bold | 3/6 a 4/6 |
| per lb. | Middling lean | 2 a 2/9 |
| Malabar, Tellicherry „ | Good to fine bold | 3/6 a 4/6 |
| Calicut „ | Brownish | 2/ a 3/ |
| Mangalore „ | Med Brown to good bold | 3/ a 5/10 |
| Ceylon, Mysore „ | Small fair to fine plump | 1/8 a 5/6 |
| Malabar „ | Fair to good | 1/7 a 1/8 |
| Seeds, E. I. & Ceylon „ | Fair to good | 1/7 a 1/8 |
| Ceylon "Long Wild" „ | Shelly to good | 1/ a 1/6 nom. |
| CHILLIES, Zanzibar cwt. | Dull to fine bright | 100/ a 110/ |
| Japan „ | Fair bright small | 80/ a 89/ |
| CINCHONA BARK.—lb. | Crown, Renewed | 3⅜d a 7d |
| Ceylon | Org. Stem | 2d a 6d |
| | Red Org. Stem | 1⅜d a 4½d |
| | Renewed | 3d a 5½d |
| | Root | 1⅞d a 4d |
| CINNAMON, Ceylon 1sts. | Fair to fine quill | 10½d a 1/6 |
| per lb. 2nds. | „ „ | 9½d a 1/5 |
| 3rds. | „ „ | 8½d a 1/3 |
| 4ths. | „ „ | 7d a 1/ |
| Chips. | Fair to fine bold | 3d a 4d |
| CLOVES, Penang lb. | Dull to fine bright pkd. | 11d a 1/1 |
| Amboyna „ | Dull to fine | 10½d a 11d |
| Zanzibar „ | Fair and fine bright | 7d a 7¾d |
| Madagascar „ | Fair | 7½d |
| Stems „ | Fair | 1¾d |
| COFFEE | | |
| Ceylon Plantation cwt. | Medium to bold | Nominal |
| Liberian „ | Fair to bold | |
| COCOA, Ceylon Plant. „ | Special Marks | 85/ a 90/6 |
| | Red to good | 78/ a 84/ |
| Native Estate „ | Ordinary to red | 57/ a 82/ |
| Java and Celebes „ | Small to good red | 70/ a 98/ |
| COLOMBO ROOT „ | Middling to good | 32/6 a 40/ |
| CROTON SEEDS, sifted „ | Dull to fair | 42/6 a 47/6 |
| CUBEBS „ „ | Ord. stalky to good | 160/ a 180/ |
| GINGER, Bengal, rough „ | Fair | 35/ |
| Calicut, Cut A „ | Medium to fine bold | 75/ a 85/ |
| B & C „ | Small and medium | 50/ a 70/ |
| Cochin, Rough „ | Common to fine bold | 40/ a 47/6 |
| | Small and D's | 40/ |
| Japan „ | Unsplit | 38/ |
| GUM Ammoniacum „ | Ord. blocky to fair clean | 60/s a 85s |
| Animi, Zanzibar | Pale and amber, str. srts | £14 10/a £16 10/ |
| „ | „ „ little red | £11 a £12 |
| „ | Bean and Pea size ditto | 70/ a £11 |
| „ | Fair to good red sorts | £8 10/ a £10 10 |
| „ | Med. and bold glassy sorts | £5 10/ a £7 5/ |
| Madagascar „ | Fair to good palish | £4 a £8 |
| | „ „ red | £4 a £7 |
| Arabic, E. I. & Aden „ | Ordinary to good pale | 45/ a 55/ nom. |
| Turkey sorts „ | ... ... | 57/6 a 60/ |
| Ghatti „ | Sorts to fine pale | 20/ a 32/6 |
| Kurrachee „ | Reddish to good pale | 25/ a 35/ nom. |
| Madras „ | Dark to fine pale | 20/ a 32/6 nom. |
| Assafœtida „ | Clean fr. to gd. almonds | £15 a £20 |
| | com. stony to good block | £4 a £10 |
| INDIGO, E.I. Bengal lb. | Shipping mid to gd. violet | 14/6 a 15/6 |
| „ | Consuming mid. to gd. | 13/9 a 14/6 |
| | Ordinary to middling | 12/6 a 13/6 |
| „ | Mid. to good Kurpah | 8/9 a 11/ |
| „ | Low to ordinary | 6/6 a 8/6 |
| „ | Mid. to fine Madras | 4/6 a 5/6 |
| KAPOK-Ceylon lb. | Ordinary to good | 5d a 7d |
| KINO lb. | Fair to fine bright | 6d a 1/5 |
| MYRRH, Aden sorts cwt. | Middling to good | 60/ a 70/ |
| Somali „ | „ „ | 50s a 60s |
| MACE, Bombay & Penang | | |
| per lb. | Pale reddish to fine | 1/10 a 2/ |
| | Ordinary to fair | 1/8 a 1/9 |
| Java | „ „ good pale | 1/8 a 1/10 |
| Bombay | Wild | 5d |

| | QUALITY. | Quotations. |
|---|---|---|
| NUTMEGS,— lb. | | |
| Singapore & Penang „ | 64's to 57's | 1/6 a 1/9 |
| | 80's | 1/2 |
| | 110's | 11d |
| NUX VOMICA, Cochin | Ordinary to good | 20/ a 23/ |
| per cwt. Bengal | „ „ | 18/ a 20/ |
| Madras | „ „ | 18/ a 21/ |
| OIL OF ANISEED lb. | Fair merchantable | 3/4½ |
| CASSIA „ | According to analysis | 3/10 a 4/1 |
| LEMONGRASS oz. | Good flavour & colour | 1¾d |
| NUTMEG „ | Dingy to white | 1½d a 1⅝d |
| CINNAMON „ | Ordinary to fair sweet | 5d a 1s 6d |
| CITRONELLE lb. | Bright & good flavour | 1/11 |
| OLIBANUM, drop „ | Good to fine white | 60s a 65s |
| „ | Middling to fair | 45s a 50s |
| pickings „ | Low to good pale | 20/ a 35/ |
| siftings „ | Slightly foul to fine | 27/6 s a 35s |
| ORCHELLA WEED—cwt | | |
| Ceylon „ | Fair | 10/6 |
| Madagascar „ | Fair | 10/6 |
| Zanzibar „ | Fair | 10/6 |
| PEPPER—(Black) lb. | | |
| Alleppy & Tellicherry | Fair | 8⅞d |
| Ceylon „ „ | Fair to fine bold heavy | 8d a 8½d |
| Singapore ... | Fair | 7⅞d |
| Acheen & W. C. Penang | Dull to fine | nom. |
| (White) Singapore „ | Fair to fine | 9½d a 10d |
| Siam „ | Fair | 9⅜d |
| Penang „ | Fair | 9¼d |
| Muntok „ | Fair | 9⅛d |
| RHUBARB, Shenzi „ | Ordinary to good | 1/6 a 3/ |
| Canton „ | Ordinary to good | 1/3 a 2/3 |
| High Dried „ | Fair to fine flat | 1/3 a 1/4 |
| | Dark to fair round | 7d a 8d |
| RUBBER, INDIA lb. | Fine Para smoked sheets | 2/5½ |
| Ceylon, Straits, „ | Crepe ordinary to fine | 2/36 |
| Malay Straits, etc. „ | Scrap fair to fine | 1/9½ |
| Assam „ | Fair 11 to ord. red No. 1. | 1/6½ |
| Rangoon „ | „ „ „ | 1/7½ |
| Borneo „ | Common to good | 1/7½ |
| Java „ | Good to fine red | 1/10 |
| Penang „ | Low white to prime red | 1/6 a 1/7 |
| Mozambique „ | Fair to fine red ball | 2/1 |
| „ | Sausage, fair to good | 2 1 |
| Nyassaland „ | Fair to fine ball | 1/11 |
| Madagascar „ | Fr. to fine pinky & white | 1/6 |
| „ | Majunga & blk coated | 1/3 |
| New Guinea „ | Niggers, low to good | 9d a 1/2 |
| | Ordinary to fine ball | 1/9 a 2/ |
| SAGO, PEARL, large—cwt | Fair to fine | 24 6 a 25/ |
| medium ... | „ „ | 24.6 a 25/ |
| small ... | „ „ | 21/ a 23/ |
| Flour ... | Good pinky to white | 17/ a 18/ |
| SEEDLAC cwt. | Ordinary to gd. soluble | 55/ a 90/ |
| SENNA, Tinnevelly lb. | Good to fine bold green | 10d/ a 1/ |
| | Fair greenish | 8½d a 9½d |
| | Common specky & small | 5d a 7d |
| SHELLS, M. o' PEARL— | Small to bold | 50/ a £5 10/ |
| Egyptian cwt. | „ „ | 60/ a £5 10/ |
| Bombay „ | Chicken to bold | £6 10/ a £10 10/ |
| Mergui „ | „ „ | £6 10/ a £10 |
| Manilla „ | Sorts | 40/ |
| Banda „ | Small to large | 55/ a 75/ |
| Green Snail „ | Mid to fine bl'k not stony | 25/ a 26 |
| TAMARINDS, Calcutta... | Inferior to good | Nominal. |
| per cwt. Madras | | |
| TORTOISESHELL— | | |
| Zanzibar & Bombay lb. | Small to bold | 10/ a 25/ |
| | Pickings | 5/ a 15/ |
| Ceylon | Small to bold | 10/ a 20 nom. |
| TURMERIC, Bengal cwt. | Fair | 32/6 nom. |
| Madras „ | Finger fair to fine bold | 32/6 a 35/ |
| Do. „ | Bulbs „ „ bright | 23/ nom. |
| Cochin „ | Finger fair | 30/ nom. |
| | Bulbs „ | 20/ nom. |
| VANILLOES— lb. | | |
| Mauritius ... } 1sts. | Gd. crystallized 3½a 8½ in. | 7/ a 12/ |
| Madagascar ... } 2nds. | Foxy & reddish 3½a „ | 7/9 a 8/3 |
| Seychelles ... } 3rds. | Lean and inferior | 7/ a 7/6 |
| WAX, Japan, squares, cwt. | Good white hard | 63/6 |

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